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ISO/WD 10303-215

Product data representation and exchange: Application Protocol: Ship arrangements

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ABSTRACT: This part of ISO 10303 defines an Application Protocol for the product data pertaining to the exchange of a ship's internal spatial subdivision.

KEYWORDS: application protocol, ship arrangements, compartmentation.

COMMENTS TO READER:

This document is the updated Working Draft of AP215 for Wide Industry Review.

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Foreword

The International Organisation for Standardisation (ISO) is a world-wide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organisations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardisation.

Draft International Standards adopted by technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International Standard ISO 10303-215 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data.*

ISO 10303 consists of the following parts under the general title *Industrial automation systems and integration — Product data representation and exchange:*

— Part 1, Overview and fundamental principles;

— Part 11, Description method: EXPRESS language reference manual;

— Part 12, Description method: EXPRESS-I language reference manual;

— Part 13, Description method: Architecture and methodology reference manual;

— Part 21, Implementation method: Clear text encoding of the exchange structure;

— Part 22, Implementation method: Standard data access interface specification;

— Part 23, Implementation method: C++ language binding to the standard data access interface;

— Part 24, Implementation method: C language binding to the standard data access interface;

— Part 26, Implementation method: Interface definition language binding to the standard data access interface;

— Part 31, Conformance testing methodology and framework: General concepts;

— Part 32, Conformance testing methodology and framework: Requirements on testing laboratories and clients;

— Part 33, Conformance testing methodology and framework: Structure and use of abstract test suites;

— Part 34, Conformance testing methodology and framework: Abstract test methods;

— Part 35, Conformance testing methodology and framework: Abstract test methods for SDAI implementations;

— Part 41, Integrated generic resource: Fundamentals of product description and support;

— Part 42, Integrated generic resource: Geometric and topological representation;

— Part 43, Integrated generic resource: Representation structures;

— Part 44, Integrated generic resource: Product structure configuration;

— Part 45, Integrated generic resource: Materials;

— Part 46, Integrated generic resource: Visual presentation;

— Part 47, Integrated generic resource: Shape variation tolerances;

— Part 49, Integrated generic resource: Process structure and properties;

— Part 101, Integrated application resource: Draughting;

— Part 102, Integrated application resource: Ship structures;

— Part 104, Integrated application resource: Finite element analysis;

— Part 105, Integrated application resource: Kinematics;

— Part 106, Integrated application resource: Building construction core model;

— Part 201, Application protocol: Explicit draughting;

— Part 202, Application protocol: Associative draughting;

— Part 203, Application protocol: Configuration controlled design;

— Part 204, Application protocol: Mechanical design using boundary representation;

— Part 205, Application protocol: Mechanical design using surface representation;

— Part 207, Application protocol: Sheet metal die planning and design;

— Part 208, Application protocol: Life cycle management - Change process;

— Part 209, Application protocol: Composite and metallic structural analysis and related design;

- Part 210, Application protocol: Design of layered electronic products;
- Part 211, Application protocol: Electronics test diagnostics and remanufacture;
- Part 212, Application protocol: Electrotechnical design and installation
- Part 213, Application protocol: Numerical control process plans for machined parts;
- Part 214, Application protocol: Core data for automotive design processes;
- Part 215, Application protocol: Ship arrangement;
- Part 216, Application protocol: Ship moulded forms;
- Part 217, Application protocol: Ship piping;
- Part 218, Application protocol: Ship structures;
- Part 220, Application protocol: Process planning, manufacture, and assembly of layered electronic products;
- Part 221, Application protocol: Functional data and their schematic representation for process plant;
- Part 222, Application protocol: Exchange of product data for composite structures;
- Part 223, Application protocol: Exchange of design and manufacturing product information for cast parts;
- Part 224, Application protocol: Mechanical product definition for process plans using mechanical feature;
- Part 225, Application protocol: Building elements using explicit shape representation;
- Part 226, Application protocol: Ship mechanical systems;
- Part 227, Application protocol: Plant spatial configuration;
- Part 228, Application protocol: Building services: Heating, ventilation, and air conditioning;
- Part 229, Application protocol: Exchange of design and manufacturing product information for forged parts;
- Part 230, Application protocol: Building structural frame: Steelwork;
- Part 231, Application protocol: Process engineering data: Process design and process specification of major equipment;
- Part 301, Abstract test suite: Explicit draughting;

— Part 302, Abstract test suite: Associative draughting;

— Part 303, Abstract test suite: Configuration controlled design;

— Part 304, Abstract test suite: Mechanical design using boundary representation;

— Part 305, Abstract test suite: Mechanical design using surface representation;

— Part 307, Abstract test suite: Sheet metal die planning and design;

— Part 308, Abstract test suite: Life cycle management - Change process;

— Part 309, Abstract test suite: Composite and metallic structural analysis and related design;

— Part 310, Abstract test suite: Design of layered electronic products;

— Part 311, Abstract test suite: Electronics test diagnostics and remanufacture;

— Part 312, Abstract test suite: Electrotechnical design and installation;

— Part 313, Abstract test suite: Numerical control process plans for machined parts;

— Part 314, Abstract test suite: Core data for automotive mechanical design processes;

— Part 315, Abstract test suite: Ship arrangement;

— Part 316, Abstract test suite: Ship moulded forms;

— Part 317, Abstract test suite: Ship piping;

— Part 318, Abstract test suite: Ship structures;

— Part 320, Abstract test suite: Process planning, manufacture, and assembly of layered electronic products;

— Part 321, Abstract test suite: Functional data and their schematic representation for process plant;

— Part 322, Abstract test suite: Exchange of product data for composite structures;

— Part 323, Abstract test suite: Exchange of design and manufacturing product information for cast parts;

— Part 324, Abstract test suite: Mechanical product definition for process plans using mechanical features;

— Part 325, Abstract test suite: Building elements using explicit shape representation;

— Part 326, Abstract test suite: Ship mechanical systems;

- Part 327, Abstract test suite: Plant spatial configuration;
- Part 328, Abstract test suite: Building services: Heating, ventilation, and air conditioning;
- Part 329, Abstract test suite: Exchange of design and manufacturing product information for forged parts;
- Part 330, Abstract test suite: Building structural frame: Steelwork;
- Part 331, Abstract test suite: Process engineering data: Process design and process specification of major equipment;
- Part 501, Application interpreted construct: Edge-based wireframe;
- Part 502, Application interpreted construct: Shell-based wireframe;
- Part 503, Application interpreted construct: Geometrically bounded 2D wireframe;
- Part 504, Application interpreted construct: Draughting annotation;
- Part 505, Application interpreted construct: Drawing structure and administration;
- Part 506, Application interpreted construct: Draughting elements;
- Part 507, Application interpreted construct: Geometrically bounded surface;
- Part 508, Application interpreted construct: Non-manifold surface;
- Part 509, Application interpreted construct: Manifold surface;
- Part 510, Application interpreted construct: Geometrically bounded wireframe;
- Part 511, Application interpreted construct: Topologically bounded surface;
- Part 512, Application interpreted construct: Faceted boundary representation;
- Part 513, Application interpreted construct: Elementary boundary representation;
- Part 514, Application interpreted construct: Advanced boundary representation;
- Part 515, Application interpreted construct: Constructive solid geometry;
- Part 516, Application interpreted construct: Mechanical design context;
- Part 517, Application interpreted construct: Mechanical design geometric presentation;
- Part 518, Application interpreted construct: Mechanical design shaded representation.

The structure of this International Standard is described in ISO10303-1. The numbering of the parts of

the International Standard reflects its structure:

- Parts 11 to 13 specify the description methods,
- Parts 21 to 26 specify the implementation methods,
- Parts 31 to 35 specify the conformance testing methodology and framework,
- Parts 41 to 49 specify the integrated generic resources,
- Parts 101 to 106 specify the integrated application resources,
- Parts 201 to 231 specify the application protocols,
- Parts 301 to 331 specify the abstract test suites, and
- Parts 501 to 518 specify the application interpreted constructs.

Should further parts be published, they will follow the same numbering pattern.

Annexes A, B, C, D, and E form an integral part of this part of ISO 10303. Annexes, F, G, H, J, and K are for information only.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product, independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organised as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. This part of ISO 10303 is a member of the application protocol series.

This part of ISO 10303 specifies an application protocol for the exchange of product data representing a ship's internal subdivision information between different organizations with a need for that data. Such organizations include ship owners, design agents, and fabricators.

This part of ISO 10303 is one of a series of shipping industry application protocols, that together aim to provide an integrated computer interpretable product model for ships.

The series of shipping industry application protocols assumes that the ship product model can be divided into separate ship systems that each cover a key element of the ship for its whole life cycle. These key elements are: ship moulded forms, ship arrangements, ship distribution systems, ship structures, ship mechanical systems, ship outfit and furnishings, and ship mission systems. Each separate system is described by one or more different application protocols. The full series of shipping application protocols is shown in Figure 1. Those aspects of the ship product model that are common to each shipping application protocol are described consistently and identically in each application protocol.

This AP has been developed to support the shipbuilding activities and computer applications associated with the Functional Design, Detail Design, and Production Engineering life cycle phases for commercial or military ships. The types of design activities and computer applications supported include structural analysis, naval architectural analyses (e.g., Longitudinal Strength, Intact and Damaged Stability, Floodable Length, Ship Motions, and Resistance and Propulsion), Weight Analysis, system penetration analysis, interference analysis, shock analysis, and material requirements definition. Figure 2 illustrates the major types of data supported by this AP. Annex L provides additional information pertaining to the industrial use of this AP.

This application protocol defines the context, scope, and information requirements for the exchange of ship arrangement definitions, geometric representations, and related properties and specifies the integrated resources necessary to satisfy these requirements.

Application protocols provide the basis for developing implementations of ISO 10303 and abstract test suites for the conformance testing of AP implementations.

Clause 1 defines the scope of the application protocol and summarises the functionality and data covered by the AP. Clause 3 lists the words defined in this part of ISO 10303 and gives pointers towards defined elsewhere. An application activity model, that is the basis for the definition of the scope, is provided by annex F. The information requirements of the application are specified in clause 4 using terminology appropriate to the application. A graphical representation of the information requirements, referred to as the application reference model, is given in annex G.

Resource constructs are interpreted to meet the information requirements. This interpretation produces the application interpreted model (AIM). This interpretation, given in 5.1, shows the correspondence between the information requirements and the AIM. The short listing of the AIM specifies the interface to the integrated resources and is given in 5.2. Note that the definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM. The expanded listing given in annex A contains the complete EXPRESS for the AIM without annotation. A graphical representation of the AIM is given in annex H. Additional requirements for specific implementation methods are given in annex D.

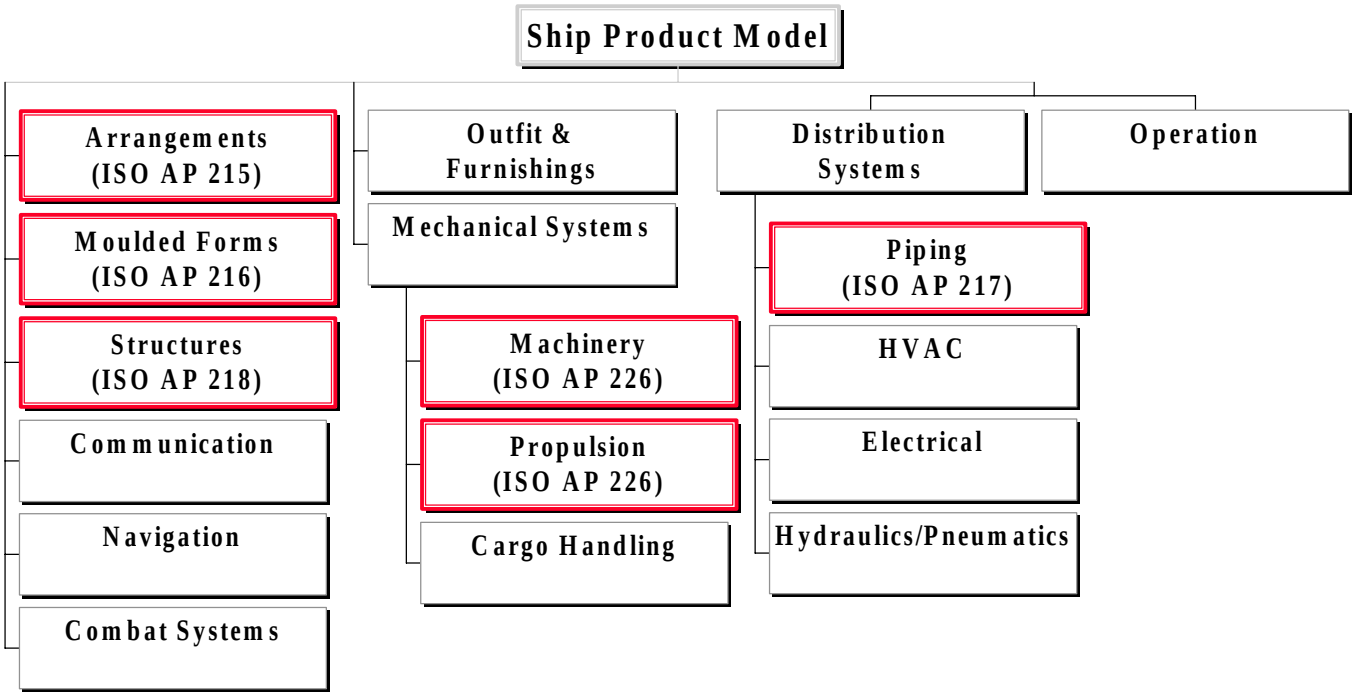

Figure 1 - The full series of shipping application protocols

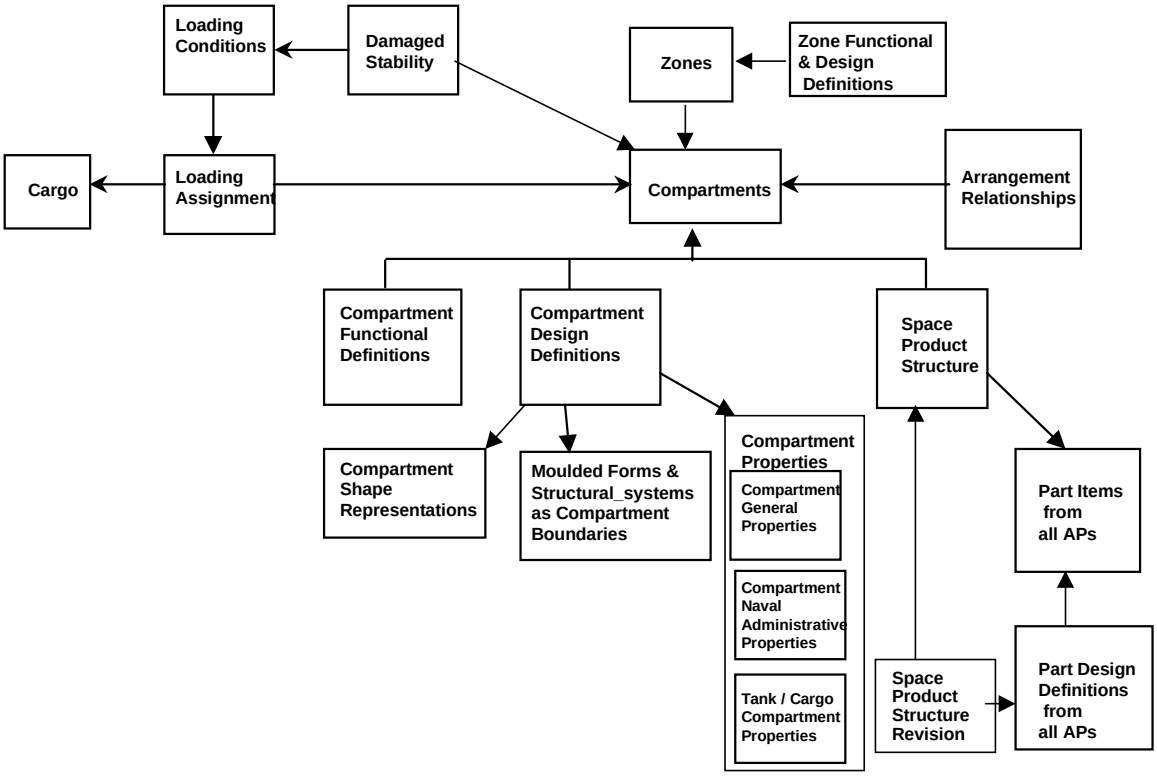

Figure 2 - Data planning model

Industrial automation systems and integration — Product data representation and exchange — Part 215: Application Protocol : Ship Arrangements

1. Scope

This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for the exchange of three-dimensional product definition data and its configuration status information for Naval and commercial ship arrangements. Configuration in this context pertains to data specific to revision tracking and change history of selected ship spatial entities within the Product model. The term exchange is used to narrow the scope to only those data which are transferred between enterprise systems. This is to distinguish it from a data model supporting distributed, multi-user database applications.

NOTE - The application activity model in annex F provides a graphical representation of the processes and information flows that are the basis for the definition of the scope of this part of ISO 10303.

The following are within the scope of this part of ISO 10303:

— data describing the general subdivision of a ship into spatially bounded regions;

— data identifying physical boundaries partitioning the ship into compartments suitable for the stowage of cargo, operation of machinery, and occupancy by crew and passengers;

— data identifying logical boundaries subdividing the ship into zones for the purpose of controlling access, designating design authority, or applying specific design requirements;

— data required for the determination of space adjacency;

— data required for recording the volumetric capacities of cargo compartments at various combinations of vessel heel, and vessel trim;

— data required for calculation of the magnitude and location of loads acting upon a ship’s structural systems due to the weight of cargos contained in the cargo compartments;

— data identifying the accessibility between adjacent spaces;

— data required for the definition of spatial boundaries based on references to moulded form regions or geometric surfaces;

— data identifying spaces related by common functional purpose;

— data identifying spaces related by position;

EXAMPLE 2 - port and starboard wing tank pairs are spaces related by position.

— data identifying spaces enclosing other spaces;

— data identifying lineal measurement constraints on dimensional aspects of spaces;

— data identifying the product structuring of engineering parts and structural parts contained within a space;

— data required for the definition of design requirements placed on a space by systems within the ship.

The following are outside the scope of this part of ISO 10303:

— data defining the representation of moulded surfaces of non-structural bulkheads. These are referenced by external instance references to 10303-216;

— data identifying the product structuring of spaces within a hull or upon a deck.

2. Normative references

The following standards contain provision which, through reference in this text, constitute provisions of this part of ISO 10303. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of the IEC and ISO maintain registers of currently valid International Standards.

ISO 31:1994, *Quantities and Units.*

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units.*

ISO 8501-1:1988, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness.*

ISO 8824-1:1994, *Information Technology — Open Systems Interconnection — Abstract Syntax Notation One (ASN.1) — Part 1: Specification of Basic notation.*

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles.*

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual.*

ISO 10303-21:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure.*

ISO 10303-31:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 31: Conformance testing methodology and framework:*

General concepts.

ISO 10303-42:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 42: Integrated generic resources: Geometric and topological representation.*

ISO 10303-43:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resources: Representation structures.*

ISO 10303-44:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 44: Integrated generic resources: Product structure configuration.*

ISO 10303-46:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 46: Integrated generic resources: Visual presentation.*

ISO 10303-216: — [1)] *Industrial automation systems and integration — Product data representation and exchange — Part 216: Application Protocol: Ship moulded forms.*

ISO 10303-218: — [1)] *Industrial automation systems and integration — Product data representation and exchange — Part 216: Application Protocol: Ship structures.*

ISO 10303-508: — [1)] *Industrial automa[1)]tion systems and integration — Product data representation and exchange — Part 508: Application interpreted constructs: : Non-manifold surface representation.*

3. Definitions and abbreviations

3.1 Terms defined in ISO 10303-1

This part of ISO 10303 makes use of the following terms defined in ISO 10303-1:

— application;

— application activity model (AAM);

— application context;

— application interpreted model (AIM);

— application object;

— application protocol (AP);

— application reference model (ARM);

[1)] To be published.

- computer aided design (CAD);
- computer aided manufacture (CAM);
- conformance class;
- conformance requirement;
- data;
- data exchange;
- implementation method;
- information;
- integrated resource;
- interpretation;
- PICS proforma;
- product;
- product data;
- unit of functionality (UoF).

3.2 Terms defined in ISO 10303-31

This part of ISO 10303 makes use of the following terms defined in ISO 10303-31:

- conformance testing;
- postprocessor;
- preprocessor.

3.3 Terms defined in ISO 10303-42

This part of ISO 10303 makes use of the following terms defined in ISO 10303-42:

- boundary;
- closed curve;
- connected;
- open curve;
- orientable.

3.4 Other definitions

For the purposes of this part of ISO 10303, the following definitions apply:

3.4.1
after perpendicular
a vertical line located at the intersection of the summer load waterline and the after side of the rudder post or sternpost, or the centerline of the rudder stock if there is no rudder post or sternpost.

3.4.2
amidships
a point located exactly mid-way between the Forward and After Perpendiculars. It is primarily used as a reference to locate or measure items longitudinally on a ship.

3.4.3
bulkhead
the vertical partition walls which subdivide the interior of a ship into compartments or rooms. The various types of bulkheads are distinguished by their location, use, kind of material, or method of fabrication, such as forepeak, longitudianl, transverse, watertight, wire mesh, pilaster, etc. Bulkheads which contribute to the strength of a vessel are called strength bulkheads, those which are essential to the watertight subdivision are watertight or oiltight bulkheads, and gastight bulkheads serve to prevent the passage of gases or fumes.

3.4.4
centroid
the center of an item, area or volume measured with respect to some defined location. Within shipbulding, it is expressed as a vertical component measured above the baseline, a transverse component measured from the centerline, and a longitudinal component measured from either Amidships, or the Forward Perpendicular.

3.4.5
collective-protective system zone
a region of a ship completely isolated from the outside environment for the purposes of protecting the crew from breathing toxic or germ infected air. This is accomplished by maintaining a positive air pressure with respect to non-protected regions.

3.4.6
compartment
a subdivision of a ship corresponding to a room in a building.

3.4.7
deck
a platform in a ship corresponding to a floor in a building. It is the plating, planking, or covering of any tier of beams either in the hull or superstructure of a ship.

3.4.8
design zone

a subdivision of a ship product model that may or may not correspond to a compartment subdivision that is used for configuration management of the product modeling process during the design phase.

3.4.9
fire zone
an abstract boundary defining a region of the ship requiring special consideration with regard to its ability to contain and/or withstand a fire. There may be several fire zones on a ship, each with different characteristics.

3.4.10
forward perpendicular
a vertical line at the intersection of the foreside of the stem profile and the summer load (i.e. design) waterline. It is commonly used as a reference point for measuring or locating items longitudinally on a ship.

3.4.11
frame
a term used to designate one of the transverse members that make up the riblike part of the skeleton of a ship. The frames act as stiffeners, holding the outside plating in shape and maintaining the transverse form of the ship.

3.4.12
hullform
the collection of geometry that defines the shape of the watertight envelope of the ship. This typically includes the underwater shell, the uppermost watertight deck or decks, and the internal watertight transverse and longitudinal bulkheads.

3.4.13
moulded form
a classification of geometry representing a reference location, curve, or surface. Structural members are located relative to the moulded form geometry according to standard practices (e.g., the inside surface of flush shell plating is on the moulded surface).

3.4.14
subdivision
the internal, spatial partitioning of a ship into volumetric-based zones or compartments for the purposes of improving survivability in the event of damage or to segregate areas of the vessel for different purposes, such as the carriage of liquids, cargo, passengers, etc.

3.4.15
subsafe zone
an abstract boundary defining a region of a ship with special design or production requirements with regard to criteria for use on a submersible vessel.

3.4.16
superstructure
a decked-over structure above the upper deck, the outboard sides of which are formed by the shell plating as distinguished from a deckhouse that does not extend outboard to the ship's sides.

3.4.17
vessel heel
rotation of a ship about the logitudinal axis.

3.4.18
vessel trim
rotation of a ship about the transverse axis.

3.4.19
zone
an abstract boundary identifying a region of a ship with unique requirements or characteristics which must be specially treated in the design and/or manufacturing process. Typically, these zones carry such designations as Design Zone, Fire Zone, CPS Zone, Subsafe Zone, Ship Work Authorization Boundary Zone, etc.

3.5 Abbreviations

For the purposes of this Part of ISO 10303, the following abbreviations apply:

AAM Application Activity Model

AIM Application Interpreted Model

AP Application Protocol

ARM Application Reference Model

CAD Computer Aided Design

CAM Computer Aided Manufacture

IMO International Maritime Organisation

PICS Protocol Implementation Conformance Statement

SI Système International

SOLAS Safety of Life at Sea

UoF Units of Functionality

4. Information Requirements

This clause specifies the information required for the exchange of ship compartmentation definitions, geometric representations and related design and operational properties.

The information requirements are specified as a set of units of functionality, application objects, and application assertions. These assertions pertain to individual application objects and to relationships between application objects. The information requirements are defined using the terminology of the subject area of this application protocol.

The units of functionality (UoF) specified within this application protocol are classified into two categories: Ship Common Model (SCM) and Spatial Arrangements as illustrated in Figure 3.

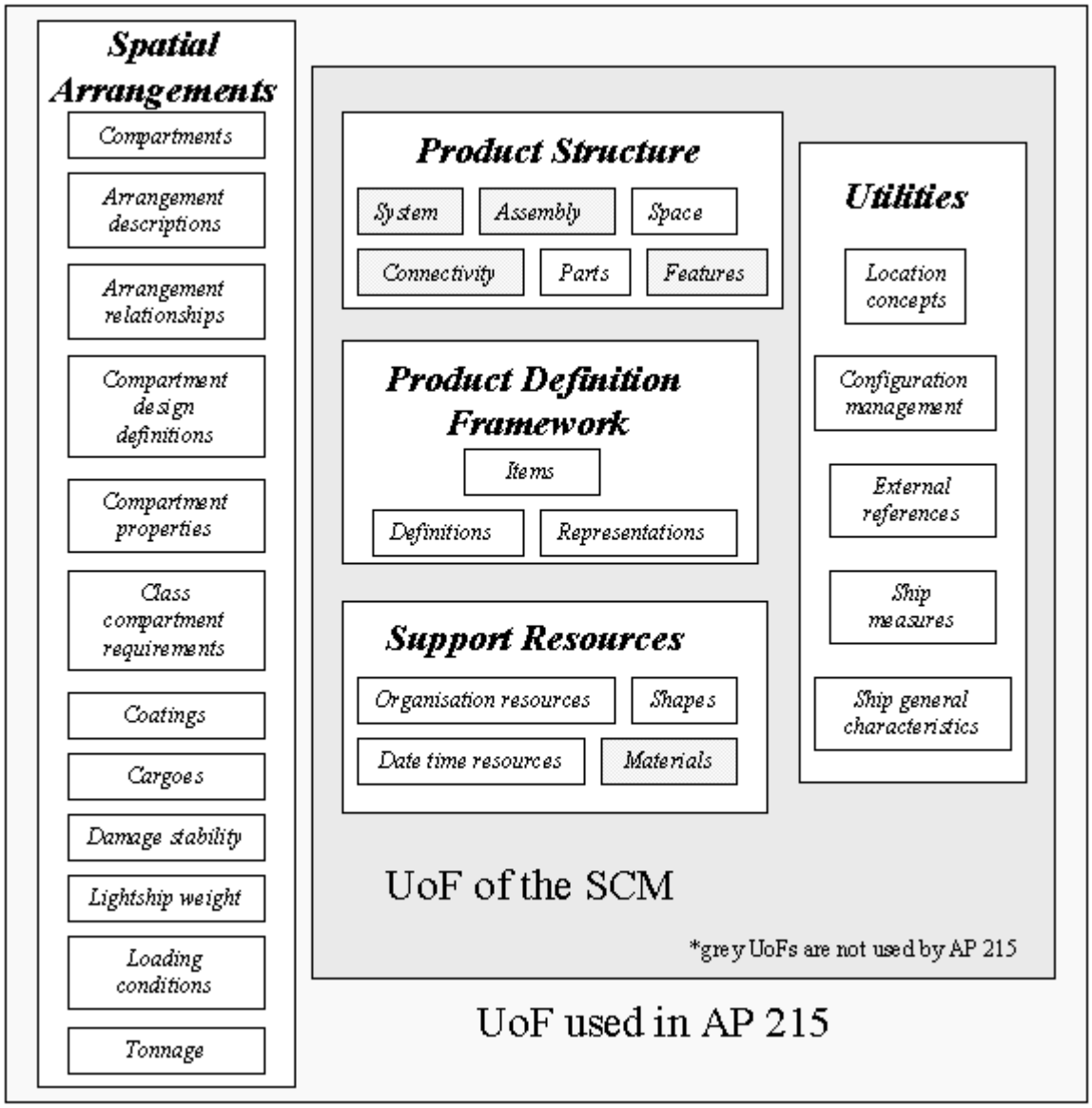

Figure 3 - Units of Functionality used in AP 215

Within Figure 3, the group of UoF's labelled "Product Definition Framework" provides the key part of the Ship Common Model and provides general concepts of how to relate things, how to define their properties and how to represent them within the suite of shipbuilding application protocols.

The group of UoF's labelled "Product Structure" provides different levels of structuring a product mainly by space, by assembly, or by system in a general manner.

The group of UoF's labelled "Support Resources" provides all ISO 10303 part 40 series resources used in within the shipbuilding AP's.

NOTE 1 - All elements in this group will not be documented in clause 4.2 as they are copies of the ISO 10303 part 40 series resources and are documented in the respective ISO 10303 part 40 series resources.

The group of UoF's labelled "Utilities" provides the information for configuration management, location concepts, external references, ship units of measure, and ship general characteristics that is used within all of the shipbuilding AP's.

The group of UoF's labelled "Spatial Arrangements" provides all the specific information that is required to define spatial arrangements on a ship.

NOTE 2 - A graphical representation of the information requirements is given in annex G. The information requirements correspond to those of the activities identified as being within the scope of this application protocol, in annex F. The mapping table specified in 5.1 shows how the integrated resources and application interpreted constructs are used to meet the information requirements of this application protocol.

4.1 Units of Functionality

This subclause specifies the units of functionality for the ship arrangements application protocol. This part of ISO 10303 specifies the following units of functionality:

— arrangement_descriptions;

— arrangement_relationships;

— cargoes;

— class_compartment_requirements;

— coatings;

— compartment_design_definitions;

— compartment_properties;

— compartments;

— configuration_management;

— damaged_stability;

- date_time_resources;
- definitions;
- external_references;
- items;
- lightship_weight;
- loading_conditions;
- location_concepts;
- organisation_resources;
- product_structures;
- representations;
- shapes;
- ship_general_characteristics;
- ship_measures;
- tonnage.

The units of functionality and a description of the functions that each UoF supports are given below. The application objects included in the UoFs are defined in 4.2.

4.1.1 arrangement_descriptions

This UoF provides text descriptions of the intended compartments on a ship prior to the existence of a geometric product model.

The following application objects are used by the arrangement_descriptions UoF:

- Arrangement_description;
- Arrangement_item_description;
- Design_requirement;
- Ship.

4.1.2 arrangement_relationships

This UoF provides information relating to the relationships between compartments that can be used to automate the generation of a preliminary compartmentation arrangement or identify

relationships between compartments after they have been populated in the product model.

The following application objects are used by the arrangement_relationships UoF:

— Adjacent_space_surface_area;

— Compartment;

— External_instance_reference;

— Item_relationship;

— Space;

— Space_adjacency_relationship;

— Space_arrangement_relationship;

— Space_connection_relationship;

— Space_enclosing_relationship;

— Space_functional_relationship;

— Space_positional_relationship;

— Zone.

4.1.3 cargoes

This UoF provides the identification of cargos that can be carried by the ship, applicable properties of those cargoes, and the assignment of those cargoes to compartments in the ship for the purpose of design or operational analysis.

The following application objects are used by the cargoes UoF:

— Absolute_cargo_position;

— Bay_cell_position;

— Bulk_cargo;

— Bulk_cargo_assignment;

— Cargo;

— Cargo_assignment;

— Cargo_bay_definition;

— Cargo_footprint;

- Cargo_material_properties;
- Cargo_position;
- Compartment;
- Compartment_cargo_assignment;
- Dangerous_goods_code;
- Deck_cargo_assignment;
- Document_reference;
- Dry_cargo;
- Gaseous_cargo;
- Lane_position;
- Liquid_cargo;
- Liquid_cargo_assignment;
- Longitudinal_position;
- Moment_3d;
- Person_group;
- Ship;
- Space;
- Spacing_position;
- Transversal_position;
- Unit_cargo;
- Unit_cargo_assignment;
- Vertical_position;
- Weight_and_centre_of_gravity.

4.1.4 class_compartment_requirements

This UoF provides the required parameters for which the ship compartmentation must be designed as specified by the applicable Classification Society.

The following application objects are used by the class_compartment_requirements UoF:

— Class_bulk_load_requirement_definition;

— Class_compartment_requirement_definition;

— Class_deck_load_requirement_definition;

— Class_tank_requirement_definition;

— Compartment;

— Design_requirement;

— Vehicle_load_description.

4.1.5 coatings

This UoF provides the identification of the type of coating used to prevent corrosion of the ship or to protect the ship in the event of fire.

The following application objects are used by the coatings UoF:

— Coating;

— Coating_certification;

— Corrosion_control_coating;

— Fire_safe_coating;

— Primer_coating.

4.1.6 compartment_design_definitions

This UoF provides the design lifecycle stage requirements, as-designed definition, and representations for compartments and zones.

The following application objects are used by the compartment_design_definitions UoF:

— Cargo_bay_definition;

— Compartment;

— Compartment_design_definition;

— Compartment_design_requirement;

— Compartment_property;

— Definable_object;

- Definition;
- Design_definition;
- Design_requirement;
- Document;
- Document_reference;
- Document_usage_constraint;
- External_instance_reference;
- External_reference;
- Global_id;
- Item;
- Longitudinal_position;
- Non_manifold_surface_shape_representation;
- Ship;
- Space;
- Spacing_position;
- Transversal_position;
- Versionable_object;
- Vertical_position;
- Zone;
- Zone_design_definition.

4.1.7 compartment_properties

This UoF provides the required, as-designed, as-built, and operational properties appropriate to a compartment.

The following application objects are used by the compartment_properties UoF:

- Capacity_properties;
- Cargo_compartment_property;

— Coating;

— Coating_certification;

— Coating_level;

— Compartment_abbreviated_name;

— Compartment_acceleration;

— Compartment_access_authorization;

— Compartment_air_circulation_rate;

— Compartment_area_property;

— Compartment_coating;

— Compartment_horizontal_cross_sectional_area_property;

— Compartment_illumination;

— Compartment_insulation;

— Compartment_naval_administrative_property;

— Compartment_noise_category;

— Compartment_nuclear_classification;

— Compartment_occupancy;

— Compartment_property;

— Compartment_safety_class;

— Compartment_security_classification;

— Compartment_stiffened_surface_area_property;

— Compartment_tightness;

— Compartment_unstiffened_surface_area_property;

— Compartment_vertical_longitudinal_cross_sectional_area_property;

— Compartment_vertical_transverse_cross_sectional_area_property;

— Compartment_volume_permeability_property;

— Compartment_volume_property;

- Compartment_ziplist_number;
- Corrosion_protection;
- General_compartment_property;
- Moments_of_inertia;
- Tank_compartment_property;
- Tank_geometric_parameters;
- Tank_piping_design_properties.

4.1.8 compartments

This UoF provides the identification and functional information about the compartments that constitute the spatial partitioning of the interior volume of the ship. It supports both the physical subdivision of the space into compartments, and the logical subdivision of the space into zones.

The following application objects are used by the compartments UoF:

- Compartment;
- Compartment_functional_definition;
- Cargo_compartment_functional_definition;
- Definable_object;
- Definition;
- External_reference;
- Functional_definition;
- Global_id;
- Habitable_compartment_functional_definition;
- Item;
- Machinery_compartment_functional_definition;
- Ship;
- Space;
- Tank_compartment_functional_definition;
- Versionable_object;

— Void_compartment_functional_definition;

— Zone;

— Zone_functional_definition.

4.1.9 configuration_management

This UoF specifies the information required to track the approval, versioning, and changes to compartment definitions. Approvals describe when, who and what has been approved and to what level of approval. Versions describe what definition is subject to versioning and how different versions are related to each other to provide a version history. Changes describes when and who changed what definition and describe the impact of the change in terms of whether or not other definitions are created, modified or deleted.

The following application objects are used by the configuration_management UoF:

— Approval_event;

— Approval_history;

— Change;

— Change_definition;

— Change_impact;

— Change_plan;

— Change_realization;

— Change_request;

— Check;

— Envisaged_version_creation;

— Event;

— Revision;

— Revision_with_context;

— Versionable_object_change_event;

— Version_creation;

— Version_deletion;

— Version_history;

— Version_modification;

— Version_relationship.

4.1.10 damaged_stability

This UoF provides the constructs for predicting the stability of the ship after it has sustained damage to the hull and an identifiable portion of the compartments.

The following application objects are used by the damaged_stability UoF:

— Cargo_assignment;

— Compartment;

— Compartment_design_definition;

— Compartment_property;

— Damage_case;

— Damage_position;

— Damage_stability_definition;

— Deadweight;

— External_instance_reference;

— Floating_position;

— Loading_condition_definition;

— Stability_definition;

— Stability_properties_for_one_floating_position;

— Stability_property;

— Stability_table.

4.1.11 date_time_resources

This UoF provides concepts to specify a date and time. This UoF is common to all Shipbuilding related Application Protocols.

The following application objects are used by the date_time_resources UoF:

Note - The application objects defined in this UoF are identical to the objects defined in STEP part 41 date_time_schema and will not be documented in the 4.2 clause.

— Coordinated_universal_time_offset;

— Date;

— Date_and_time;

— Local_time.

4.1.12 definitions

This UoF provides the information for a general product definition based on product lifecycle or product structure and how definitions are related to each other.

The following application objects are used by the definitions UoF:

— Definition;

— Design_definition;

— Functional_definition;

— General_characteristics_definition.

4.1.13 external_references

This UoF provides concepts for external references to something outside a given data exchange or data sharing context and provides information for the identification and reference of standards and documents defined outside ISO 10303. This UoF is common to all Shipbuilding related Application Protocols.

The following application objects are used by the external_references UoF:

— Document;

— Document_reference;

— Document_referent;

— Document_usage_constraint;

— External_instance_reference;

— External_reference;

— Universal_resource_locator.

4.1.14 items

This UoF provides the information required for the definition of a general lifecycle independent structure of the product and relationships between its components. This UoF is common to all Shipbuilding related Application Protocols.

The following application objects are used by the items UoF:

— Definable_object;

— Global_id;

— Item;

— Item_relationship;

— Item_structure;

— Ship;

— Versionable_object.

4.1.15 lightship_weight

This UoF defines the weight of the ship's hull structure, including the weight of any installed machinery and outfitting, but excluding the weight of the crew, any passengers and cargoes.

The following application objects are used by the lightship_weight UoF:

— Lightship_definition;

— Lightship_weight_item.

4.1.16 loading_conditions

This UoF provides design and operational definitions the weight of the ship including assigned cargoes and occupants.

The following application objects are used by the loading_conditions UoF:

— Cargo_assignment;

— Deadweight;

— Floating_position;

— Loading_condition_definition;

— Loading_condition_design_definition;

— Loading_condition_operating_definition;

— Ship.

4.1.17 location_concepts

This UoF provides different concepts of positioning for items of the ship. This includes the information required to define the ship's global co-ordinate system, local co-ordinate systems, and spacing tables. This UoF is common to all Shipbuilding related Application Protocols.

The following application objects are used by the location_concepts UoF:

- Buttock_table;
- Frame_table;
- Global_axis_placement;
- Local_co_ordinate_system;
- Local_co_ordinate_system_with_position_reference;
- Longitudinal_position;
- Longitudinal_table;
- Spacing_position;
- Spacing_position_with_offset;
- Spacing_table;
- Station_table;
- Transversal_position;
- Transversal_table;
- Vertical_position;
- Vertical_table;
- Waterline_table.

4.1.18 organisation_resources

This UoF provides the information for representing data about persons, organisations and their addresses. This UoF is common to all Shipbuilding related Application Protocols.

The following application objects are used by the organisation_resources UoF:

NOTE 1 - The application objects defined in this UoF are identical to the objects defined in STEP part 41 person_organization_schema and will not be documented in the 4.2 clause.

- Address;

— Organization;

— Person;

— Person_and_organization.

4.1.19 product_structures

This UoF provides the constructs for identifying which structural, mechanical, or distributed system parts are contained within or form the boundary of a compartment or zone.

The following application objects are used by the product_structures UoF:

— Definable_object;

— Definition;

— Design_definition;

— External_instance_reference;

— External_reference;

— Global_id;

— Item;

— Item_relationship;

— Item_structure;

— Part;

— Revision;

— Revision_with_context;

— Ship;

— Space;

— Space_product_structure;

— Space_product_structure_revision;

— Versionable_object.

4.1.20 representations

This UoF provides the information required for generic representations associated with definitions. This UoF is common to all Shipbuilding related Application Protocols.

The following application objects are used by the representations UoF:

NOTE - The application objects defined in this UoF are identical to the objects defined in STEP part 41 representation_schema and will not be documented in the 4.2 clause.

- Representation;
- Representation_context;
- Representation_item.

4.1.21 shapes

This UoF provides the information required for the definition of the geometric representation of compartments and zones. This UoF is common to all Shipbuilding related Application Protocols.

The following application objects are used by the shapes UoF:

NOTE - The application objects defined in this UoF are identical to the objects defined in ISO 10303-508 and will not be documented in the 4.2 clause.

- Cartesian_point;
- Geometric_representation_context;
- Geometric_representation_item;
- Non_manifold_surface_shape_representation;
- Point;
- Shape_representation.

4.1.22 ship_general_characteristics

This UoF provides ship identification information for ship owners, shipbuilders and classification societies. This UoF is common to all Shipbuilding related Application Protocols.

The following application objects are used by the ship_general_characteristics UoF:

- Class_and_statutory_designation;
- Class_notation;
- Owner_designation;

- Regulation;
- Ship_designation;
- Shipyard_designation.

4.1.23 ship_measures

This UoF provides the information for representing measures for physical quantities. The UoF is common to all Shipbuilding related Application Protocols.

The following application objects are used by the ship_measures UoF:

NOTE - The application objects defined in this UoF are identical to the objects defined in STEP part 41 measures_schema and will not be documented in the 4.2 clause.

- Area_measure;
- Count_measure;
- Density_measure;
- Derived_unit;
- Derived_unit_element;
- Dimensional_exponents;
- Force_measure;
- Inertia_moment_measure;
- Length_measure;
- Luminous_intensity_measure;
- Mass_measure,
- Moment_measure;
- Named_unit;
- Percentage;
- Plane_angle_measure;
- Positive_length_measure;
- Pressure_measure;
- Ratio_measure;

— Thermodynamic_temperature_measure;

— Unit;

— Volume_measure.

4.1.24 tonnage

This UoF provides the estimated capacity of the ship using rules established by the international Classification Societies.

The following application objects are used by the tonnage UoF:

— Compartment;

— Compartment_group;

— Compensated_gross_tonnage;

— Gross_tonnage;

— Net_tonnage;

— Tonnage_definition;

— Tonnage_measurement.

4.2 Application objects

This subclause specifies the application objects for the ship arrangements application protocol. Each application object is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the object. The application objects and their definitions are given below.

4.2.1 Absolute_cargo_position

An Absolute_cargo_position is a type of Cargo_position (see 4.2.18). It is the position of a unit of Cargo (see 4.2.12) in the global co-ordinate system of the Ship (see 4.2.122).

The data associated with an Absolute_cargo_position are the following:

— orientation;

— position.

4.2.1.1 orientation

The orientation specifies the orientation of the unit of cargo. It specifies the angle between the X-axis of the local co-ordinate system of the Unit_cargo (see 4.2.149) and the X-axis of the global co-ordinate system of the ship, given that the Z-axes of the two co-ordinate systems are parallel.

The angle is positive if the rotation cargo X-axis of the unit of Cargo is in a counter-clockwise direction with respect to the global X-axis of the Ship.

4.2.1.2 position

The position specifies the location of the origin of the local co-ordinate system of the unit of Cargo within the global co-ordinate system of the Ship.

4.2.2 Adjacent_space_surface_area

An Adjacent_space_surface_area is the area of that portion of the boundary between adjacent Spaces (see 4.2.125) that is common to both Spaces.

EXAMPLE - Two compartments are divided by a longitudinal bulkhead 8.0 ft high. One compartment is 10.0 ft wide and the other is 6.0 ft wide. The adjacent_space_surface_area would be 48.0 square feet (8.0 ft x 6.0 ft).

The data associated with an Adjacent_space_surface_area are the following:

— surface_area.

The surface_area specifies the area measure of shared boundary between the adjacent Spaces.

4.2.3 Approval_event

An Approval_event is a type of Event (see 4.2.83) that records a change in the status of the organizational review and approval of some product data.

The data associated with an Approval_event are the following:

— approval_reference;

— result;

— user_defined_result.

4.2.3.1 approval_reference

The approval_reference specifies the Approval_history (see 4.2.4) effected by the event. Every Approval_event must refer to exactly one Approval_history.

4.2.3.2 result

The result specifies that product data for a version of the design is to be reviewed, or has been reviewed by an authorized member of the organization and has been approved, rejected, or has some other project-specific status.

The value of result is one of the following:

— unapproved;

— approved;

— rejected;

— user_defined.

NOTE - See 4.2.3.2.1 - 4.2.3.2.4 for the definition of each allowable value for result.

4.2.3.2.1 unapproved

unapproved: the product data has not yet been reviewed or is in the process of being reviewed for approval by the organization.

4.2.3.2.2 approved

approved: the product data has been reviewed by the appropriate organization and is approved for use in the ship.

4.2.3.2.3 rejected

rejected: the product data has been reviewed by the appropriate organization and is not approved for use in the ship. Other product data would normally be created to replace the rejected product data

4.2.3.2.4 user_defined

user_defined: project-specific approval status code to be determined by two or more exchanging organizations.

4.2.3.3 user_defined_result

The user_defined_result is optional and if present, specifies a user-defined approval status.

4.2.4 Approval_history

An Approval_history is a collection of all Approval_events (see 4.2.3) of a specific type defined for a portion of product data.

The data associated with an Approval_history are the following:

— approvals;

— status;

— subject.

4.2.4.1 approvals

The approvals specifies the sequence of Approval_events (see 4.2.3) having occurred up to this point in time. The history must consist of at least one Approval_event. The sequence of Approval_events is assumed to be in chronological order.

4.2.4.2 status

The status specifies the current approval status.

The value of status is one of the following:

— unapproved;

— approved;

— rejected;

— user_defined.

NOTE - See 4.2.4.2.1 - 4.2.4.2.4 for the definition of each allowable value for status.

4.2.4.2.1 unapproved

unapproved: the product data has not yet been reviewed or is in the process of being reviewed for approval by the organization.

4.2.4.2.2 approved

approved: the product data has been reviewed by the appropriate organization and is approved for use in the ship.

4.2.4.2.3 rejected

rejected: the product data has been reviewed by the appropriate organization and is not approved for use in the ship. Other product data would normally be created to replace the rejected product data

4.2.4.2.4 user_defined

user_defined: project-specific approval status code to be determined by two or more exchanging organizations.

4.2.4.3 subject

The subject specifies the product data this approval is related to.

NOTE - A Definition may have zero, one, or many associated approvals. In case it has more than one associated approval, all of them shall be different.

4.2.5 Arrangement_description

An Arrangement_description is a type of Design_requirement (see 4.2.77) that generally describes the Ship (see 4.2.122) arrangement.

The data associated with an Arrangement_description are the following:

— defined_for;

— item_descriptions.

4.2.5.1 defined_for

The defined_for specifies the Ship for which an Arrangement_description is valid.

4.2.5.2 item_descriptions

The item_descriptions specifies data sheets for each Compartment (see 4.2.35) or Zone (see 4.2.164) in a Ship.

4.2.6 Arrangement_item_description

An Arrangement_item_description is a type of Design_requirement (see 4.2.77) that offers a preliminary identification and description of the principal geometric properties of an intended Zone (see 4.2.164) or Compartment (see 4.2.35) prior to the existence of geometric product data.

The data associated with an Arrangement_item_description are the following:

— area;

— breadth;

— height;

— identifier;

— length_longitudinal;

— purpose;

— type_of_arrangement_item;

— volume.

4.2.6.1 area

The area specifies the estimated horizontal cross-sectional area covered by the arrangement item.

4.2.6.2 breadth

The breadth specifies the expected breadth covered by the arrangement item perpendicular to the length_longitudinal.

4.2.6.3 height

The height specifies the expected height covered by the arrangement item.

4.2.6.4 identifier

The identifier specifies the name for the Arrangement_item_description using an organization or project-specific naming convention, such as a Compartment classification system.

4.2.6.5 length_longitudinal

The length_longitudinal specifies the expected length in the longitudinal direction of the ship covered by the arrangement item.

4.2.6.6 purpose

The purpose specifies the description of the use of this item, describing intended function and special requirements to be considered during the design phase.

4.2.6.7 type_of_arrangement_item

The type_of_arrangement_item specifies a meaningful name for the Arrangement_item_description using shipbuilding terminology.

EXAMPLE - cargo room, engine room, fore peak, fresh water tank, pantry.

4.2.6.8 volume

The volume specifies the estimated volume of the room described.

4.2.7 Bay_cell_position

A Bay_cell_position is a type of Cargo_position (see 4.2.18) that is the position of a unit of Cargo (see 4.2.12) in terms of cargo bays in a Ship (see 4.2.122) Compartment (see 4.2.35) or on a deck.

The data associated with a Bay_cell_position are the following:

— bay_number;

— relating_to;

— row;

— tier.

4.2.7.1 bay_number

The bay_number specifies the transverse position of the bay within the bay definition.

4.2.7.2 relating_to

The relating_to specifies the defintion of the bay structure of the Ship.

4.2.7.3 row

The row specifies the longitudinal position of the bay within the bay definition.

4.2.7.4 tier

The tier specifies the vertical position of the bay within the bay definition.

4.2.8 Bulk_cargo

A Bulk_cargo is a type of Dry_cargo (see 4.2.81). It is solid Cargo (see 4.2.12) that is not packed, but is carried loose such as grain or coal.

EXAMPLE - grain or coal are bulk cargo.

The data associated with a Bulk_cargo are the following:

— natural_angle_of_repose;

— type_of.

4.2.8.1 natural_angle_of_repose

The natural_angle_of_repose specifies the angle naturally subtended with the horizontal by the upper surface of the conic pile, made by the Bulk_cargo when loaded into a hold by a chute using gravity alone.

4.2.8.2 type_of

The type_of specifies the type of Bulk_cargo that can be loaded into the Ship (see 4.2.122). A Bulk_cargo is one that is not packed, but is loaded loose. The standard Oxford English Dictionary definitions for the Cargo types apply.

The value of type_of is one of the following:

— grain;

— ore;

— coal;

— sugar;

— general;

— cement;

— fish;

— mud;

— timber;

— unspecified.

NOTE - See 4.2.8.2.1 - 4.2.8.2.10 for the definition of each allowable value for type_of.

4.2.8.2.1 grain

grain: The Bulk_cargo is grain.

4.2.8.2.2 ore

ore: The Bulk_cargo is ore.

4.2.8.2.3 coal

coal: The Bulk_cargo is coal.

4.2.8.2.4 sugar

sugar: The Bulk_cargo is sugar.

4.2.8.2.5 general

general: The Bulk_cargo is of a general, non-specified, type

4.2.8.2.6 cement

cement: The Bulk_cargo is cement.

4.2.8.2.7 fish

fish: The Bulk_cargo is fish.

4.2.8.2.8 mud

mud: The Bulk_cargo is mud.

4.2.8.2.9 timber

timber: The Bulk_cargo is timber.

4.2.8.2.10 unspecified

unspecified: The Bulk_cargo is of an unspecified type.

4.2.9 Bulk_cargo_assignment

A Bulk_cargo_assignment is a type of Compartment_cargo_assignment (see 4.2.41) that is Bulk_cargo (see 4.2.8) that has been allocated and loaded into a Compartment (see 4.2.35).

The data associated with a Bulk_cargo_assignment are the following:

— actual_angle_of_repose;

— trimmed.

4.2.9.1 actual_angle_of_repose

The actual_angle_of_repose specifies the actual angle subtended with the horizontal by the upper surface of the conic pile, made by the Bulk_cargo when loaded into a hold.

4.2.9.2 trimmed

The trimmed specifies the natural pile of bulk cargo that has been flattened and spread out to fill the compartment.

4.2.10 Buttock_table

A Buttock_table is a spacing table whose positions are a reference for the location of buttocks and are located on the global Y axis.

4.2.11 Capacity_properties

A Capacity_properties is a measure of volumetric characteristics of a tank or cargo type of Compartment (see 4.2.35), computed at some specific combination of level, trim, and heel angle. The level represents the imaginary planar surface at the cargo and non-cargo interface and is relative to a capacity level origin established for the Compartment. The attitude of the plane is adjusted to co-incide with a vector having a magnitude equal to the level and a direction reflecting the vessel heel and trim. A Compartment may have any number of combinations of capacity values, each having a different value for capacity_context.

The data associated with a Capacity_properties are the following:

— capacity_center;

— capacity_context;

— capacity_heel_angle;

— capacity_level;

— capacity_level_origin;

— capacity_trim_angle;

— capacity_volume;

— user_defined_capacity_context.

4.2.11.1 capacity_center

The capacity_center specifies the position of the volumetric center of the interior region of space formed by the Compartment boundaries and the imaginary plane representing the cargo and non-cargo interface.

4.2.11.2 capacity_context

The capacity_context specifies values representing the significant capacity states.

The value of capacity_context is one of the following:

— pressed_full;

— full_95_percent;

— full_98_percent;

— slack;

— user_defined.

NOTE - See 4.2.11.2.1- 4.2.11.2.5 for the definition of each allowable value for capacity_context.

4.2.11.2.1 pressed_full

pressed_full: the capacity properties are defined for a full tank or cargo Compartment in which no volume is left for expansion and the Cargo is hard against the tank top and into the vent pipe.

4.2.11.2.2 full_95_percent

full_95_percent: the capacity properties are defined for a 95 percent full tank or cargo Compartment.

4.2.11.2.3 full_98_percent

full_98_percent: the capacity properties are defined for a 98 percent full tank or cargo Compartment.

4.2.11.2.4 slack

slack: the capacity properties are defined for a value other than 95 percent, 98 percent, or pressed_full.

4.2.11.2.5 user_defined

user_defined: the capacity properties are defined for a tank filled to a level specified in the user_defined_value attribute.

4.2.11.3 capacity_heel_angle

The capacity_heel_angle specifies the amount of rotation about the longitudinal axis of the Ship that has been factored into the capacity calculation for the plane representing the interface between the cargo and non-cargo regions of the Compartment.

4.2.11.4 capacity_level

The capacity_level specifies the distance between the bottom of the Compartment expressed as the capacity_level_origin and the top of an imaginary plane representing the cargo and non-cargo interface. It is measured along a vector offset from the vertical to reflect the capacity heel angle and the capacity trim angle.

4.2.11.5 capacity_level_origin

The capacity_level_origin specifies a cartesian point associated with a tank or cargo type of Comparment that represents the vertical reference for measuring the capacity depth levels corresponding to a set of Compartment capacities. It may be chosen to represent the bottom of the Compartment, the bottom of the sounding tube, or any other convenient location.

4.2.11.6 capacity_trim_angle

The capacity_trim_angle specifies amount of rotation about the transverse axis of the Ship that has been factored into the capacity calculation for the plane representing the interface between the cargo and non-cargo regions of the Compartment.

4.2.11.7 capacity_volume

The capacity_volume specifies the enclosed volumetric measurement of the interior region of space formed by the Compartment boundaries and the imaginary plane representing the cargo and non-cargo interface.

4.2.11.8 user_defined_capacity_context

The user_defined_capacity_context is optional and if present, specifies the capacity context of the user_defined value.

4.2.12 Cargo

A Cargo is any item of temporary nature loaded onboard a Ship (see 4.2.122) for the purpose of being consumed during the voyage, used by the crew or passengers, transferred to another Ship while underway, or offloaded at one of the destination ports. Cargo may be secured from shifting during the voyage, but is not permanently afixed to the Ship. Each Cargo is either a Liquid_cargo (see 4.2.102), a Gaseous_cargo (see 4.2.90), or a Dry_cargo (see 4.2.81).

The data associated with a Cargo are the following:

— cargo_hazard;

— description;

— flash_point;

— material_properties;

— pollution_code;

— references;

— required_carriage_temperature;

— type_code.

4.2.12.1 cargo_hazard

The cargo_hazard is optional and if present, specifies the classification of the hazards associated with the Cargo.

4.2.12.2 description

The description specifies a free text description of the Cargo.

4.2.12.3 flash_point

The flash_point specifies the temperature at which the Cargo shall spontaneously combust.

4.2.12.4 material_properties

The material_properties is optional and if present, specifies the physical properties of the material that makes up the Cargo on a ship.

4.2.12.5 pollution_code

The pollution_code specifies the degree to which the Cargo will cause pollution of the sea if released. These are according to MARPOL 73 -78, Annex II.

The value of pollution_code is one of the following:

— code_A;

— code_B;

— code_C;

— code_D.

NOTE - See 4.2.12.5.1- 4.2.12.5.4 for the definition of each allowable value for pollution_code.

4.2.12.5.1 code_A

code_A: the cargo cannot be released into the sea.

4.2.12.5.2 code_B

code_B: 0.1 cubic metres per tank of Cargo can be released into the sea.

4.2.12.5.3 code_C

code_C: 0.3 cubic metres per tank of Cargo can be released into the sea.

4.2.12.5.4 code_D

code_D: the cargo can be released into the sea so long as it is diluted.

4.2.12.6 references

The references specifies the Document_references (see 4.2.79) that may be of relevance to the carriage of the Cargo. These references may be material data sheets, technical specifications, or additional safety information.

4.2.12.7 required_carriage_temperature

The required_carriage_temperature specifies the required temperature of the Cargo while it is stowed.

4.2.12.8 type_code

The type_code specifies the type of the Cargo. This is the number relating to each product as shown in the recommendations proposed by the United Nations Committee of Experts on the Transport of Dangerous Goods, New York, 1977, ST SG AC.10 1 Rev. 1.0 and used by the MARPOL and BCH codes.

4.2.13 Cargo_assignment

A Cargo_assignment is the allocation of a Cargo (see 4.2.12) to a Space (see 4.2.125) within a Ship (see 4.2.122). Each Cargo_assignment is either a Compartment_cargo_assignment (see 4.2.41) or a Deck_cargo_assignment (see 4.2.73).

The data associated with a Cargo_assignment are the following:

— allocated_weight;

— assignment_context.

4.2.13.1 allocated_weight

The allocated_weight specifies the actual mass of cargo that has been loaded.

4.2.13.2 assignment_context

The assignment_context specifies the context for the loading of cargo on the ship.

The value of assignment_context is one of the following:

— cargo_assnmnt;

— stores;

— accomodation;

— unspecified.

NOTE - See 4.2.13.2.1- 4.2.13.2.4 for the definition of each allowable value for assignment_context.

4.2.13.2.1 cargo_assnmnt

cargo_assnmnt: the cargo assignment is a loading of cargo for shipping.

4.2.13.2.2 stores

stores: the cargo assignment is the loading of stores for the use of the passengers and crew on the journey.

4.2.13.2.3 accomodation

accomodation: the cargo assignment is the loading of furnishings for the accomodation areas of the ship.

4.2.13.2.4 unspecified

unspecified: the cargo assigment is of no specific type. This can be used for defining theoretical loads for analytical purposes.

4.2.14 Cargo_bay_definition

A Cargo_bay_definition is a type of Definition (see 4.2.75) that defines a grid of positions within a Compartment (see 4.2.35) that are used to specify the location of placement of Cargo (see 4.2.12) within that Compartment.

The data associated with a Cargo_bay_definition are the following:

— defined_for;

— longitudinal_cargo_positions;

— transverse_cargo_positions;

— vertical_cargo_positions.

4.2.14.1 defined_for

The defined_for specifies the Compartment that is referenced by the Cargo_bay_definition.

4.2.14.2 longitudinal_cargo_positions

The longitudinal_cargo_positions specifies longitudinal positions that locate the placement of Cargo.

4.2.14.3 transverse_cargo_positions

The transverse_cargo_positions specifies transverse positions that locate the placement of Cargo.

4.2.14.4 vertical_cargo_positions

The vertical_cargo_positions specifies vertical positions that locate the placement of Cargo.

4.2.15 Cargo_compartment_property

A Cargo_compartment_property is a type of Compartment_property (see 4.2.54) that describes properties for Cargo (see 4.2.12) capacities and Cargo densities for which the cargo Compartment (see 4.2.35) is designed.

The data associated with a Cargo_compartment_property are the following:

— bulk_cargo_capacity;

— design_stowage_density.

4.2.15.1 bulk_cargo_capacity

The bulk_cargo_capacity is optional and if present, specifies volumetric characteristics of a cargo Compartment.

4.2.15.2 design_stowage_density

The design_stowage_density specifies the measure of the quantity per unit volume of the dry Bulk_cargo (see 4.2.8) for which the cargo Compartment is designed.

4.2.16 Cargo_footprint

A Cargo_footprint is the size and position of the area of contact of a Cargo (see 4.2.12) with the deck or support.

The data associated with a Cargo_footprint are the following:

— contact_material;

— position;

— shape;

— transferred_mass.

4.2.16.1 contact_material

The contact_material specifies the type of material that is in contact with the structure of the Ship (see 4.2.122).

The value of contact_material is one of the following:

— rubber;

— pneumatic;

— metal;

— other.

NOTE - See 4.2.16.1.1 - 4.2.16.1.4 for the definition of each allowable value for contact_material.

4.2.16.1.1 rubber

rubber: solid rubber is in contact with the ship.

4.2.16.1.2 pneumatic

pneumatic: air filled material is in contact with the ship.

4.2.16.1.3 metal

metal: metal is in contact with the ship.

4.2.16.1.4 other

other: the material in contact with the deck is not specified.

4.2.16.2 position

The position specifies the location of the centre of area of the footprint with respect to the local co-ordinate system of the Cargo.

4.2.16.3 shape

The shape specifies the definition of the shape of the footprint.

4.2.16.4 transferred_mass

The transferred_mass specifies the mass of the Cargo that is transferred to the deck via the footprint.

4.2.17 Cargo_material_properties

A Cargo_material_properties is the physical properties associated with the Cargo (see 4.2.12).

The data associated with a Cargo_material_properties are the following:

— density;

— expansion_coefficient;

— specific_heat_capacity;

— thermal_conductivity;

— viscosity.

4.2.17.1 density

The density specifies the mass per unit volume of the Cargo.

4.2.17.2 expansion_coefficient

The expansion_coefficient specifies the coefficient of volumetric thermal expansion. It is used to define the relationship between expansion and temperature change of the Cargo material.

4.2.17.3 specific_heat_capacity

The specific_heat_capacity specifies the amount of energy required to raise the temperature of a kilogram of Cargo material by one degree Centigrade.

4.2.17.4 thermal_conductivity

The thermal_conductivity specifies the rate at which the Cargo will conduct heat.

4.2.17.5 viscosity

The viscosity specifies the kinematic viscosity of the Liquid_cargo (see 4.2.102). When multiplied by the Reynolds number, it gives the fluid velocity over a linear dimension.

4.2.18 Cargo_position

A cargo_position is the position of a unit of Cargo (see 4.2.12) in terms of either the bays in a Compartment (see 4.2.35) or on the deck of a Ship (see 4.2.122) or by a Ship co-ordinate. Each Cargo_position may be one of the following: an Absolute_cargo_position (see 4.2.1), a Bay_cell_position (see 4.2.7), or a Lane_position (see 4.2.99).

4.2.19 Change

A Change is a type of Item (see 4.2.96) that represents the focus of all stages associated with a potential or actual change to the product model resulting from a customer or design organization change order. The change may or may not result in modifications to the product model data. Any planned or actual changes to the product model are documented in the associated Change_definitions (see 4.2.20).

The data associated with a Change are the following:

— the_class.

The the_class specifies the qualification of the organizational role of the change.

EXAMPLE - Headquater Modification Request or Engineering Change Proposal.

4.2.20 Change_definition

A Change_definition is a type of Definition (see 4.2.75) that is the generalization of the major discrete stages of a Change (see 4.2.19). Each Change_definition is either a Change_request (see 4.2.24), Change_plan (see 4.2.22), or a Change_realization (see 4.2.23).

The data associated with a Change_definition are the following:

— author;

— date_time;

— defined_for;

— local_units.

4.2.20.1 author

The author specifies the person or organization responsible for the change activities during the period lasting from the end of the previous, if it exists, up to the end of this Change_definition.

4.2.20.2 date_time

The date_time specifies the date and time when the state of the Change_definition was reached.

4.2.20.3 defined_for

The defined_for specifies the Change to which the Change_definition is applicable.

4.2.20.4 local_units

The local_units specifies that a Change_definition shall not define local units.

4.2.21 Change_impact

A Change_impact is the effect a Change (see 4.2.21) shall cause or has caused.

The data associated with a Change_impact are the following:

— impact.

The impact specifies the effect of a Change in terms of the creation, modification, or deletion of some Definitions (see 4.2.75), Item_structures (see 4.2.98), or Item_relationships (see 4.2.97).

4.2.22 Change_plan

A Change_plan is a type of Change_definition (see 4.2.20) that defines the proposed solution for a Change (see 4.2.19). It is the basis for the activities, i.e., the Versionable_object_change_events (see 4.2.159) necessary to implement the Change in the product model.

The data associated with a Change_plan are the following:

— checks;

— chosen_solution_for;

— planned_impact.

4.2.22.1 checks

The checks specifies the verifications planned for the Change.

4.2.22.2 chosen_solution_for

The chosen_solution_for specifies identification of the Change_request (see 4.2.24) for which a Change_plan is applicable.

4.2.22.3 planned_impact

The planned_impact specifies the estimated or calculated effects of the Change. This impact is usually chosen from the set of solution alternatives of a Change_request (see 4.2.24).

4.2.23 Change_realization

A Change_realization is a type of Change_definition (see 4.2.20) that defines the actual, observed effects of a Change (see 4.2.19).

The data associated with a Change_realization are the following:

— checks;

— impact;

— realization_of.

4.2.23.1 checks

The checks specifies organizational approval of the product model revisions made to implement the Change.

4.2.23.2 impact

The impact specifies identification of the revisions made to the product model.

4.2.23.3 realization_of

The realization_of specifies the Change_plan (see 4.2.22) for which a product model change is being implemented.

4.2.24 Change_request

A Change_request is a type of Change_definition (see 4.2.20) that defines the first phase of a Change, where the need for a Change (see 4.2.19) and possible solution alternatives are established.

The data associated with a Change_request are the following:

— addressee;

— initiator;

— problem;

— solution_alternatives;

— solution_description.

4.2.24.1 addressee

The addressee is optional and if present, specifies the person or organization the request is addressed to.

4.2.24.2 initiator

The initiator specifies the person or organization the request is coming from.

4.2.24.3 problem

The problem specifies a description of the problem having induced the request.

4.2.24.4 solution_alternatives

The solution_alternatives specifies alternative solutions proposed to solve the problem. A solution is described in terms of the effect on versionable objects.

4.2.24.5 solution_description

The solution_description is optional and if present, specifies a description of one or more possible solutions for the problem. This description should be present, if the solution_alternatives are not yet established, or may enhance the information provided by the solution_alternatives.

4.2.25 Check

A Check is a type of Event (see 4.2.83) that defines the details of a planned or fulfilled approval within an organization for a Change_plan (see 4.2.22) or a Change_realization (see 4.2.23).

4.2.26 Class_and_statutory_designation

A Class_and_statutory_designation is a type of General_characteristics_definition (see 4.2.91) that specifies the identification given to the Ship (see 4.2.122) by the classification society for the purpose of design, manufacture, and in-service approval.

The data associated with a Class_and_statutory_designation are the following:

— class_number;

— local_units;

— the_class;

— the_statutory.

4.2.26.1 class_number

The class_number specifies a classification society specific identifier to a Ship.

4.2.26.2 local_units

The local_units specifies that a Class_and_statutory_designation shall not define local units

4.2.26.3 the_class

The the_class specifies the applicable Class_notation (see 4.2.30) with information about the Ship type and the Cargo (see 4.2.12).

4.2.26.4 the_statutory

The the_statutory specifies the set of national and international regulations and standards with which the Ship is intended to comply.

4.2.27 Class_bulk_load_requirement_definition

A Class_bulk_load_requirement_definition is a type of Class_compartment_requirement_definition (see 4.2.28) that describes properties for bulk load Compartments (see 4.2.35) that are specifically required for performing a hull design approval by rules.

The data associated with a Class_bulk_load_requirement_definition are the following:

— angle_of_repose;

— bulk_cargo_mass;

— permeability;

— top_of_hatch.

4.2.27.1 angle_of_repose

The angle_of_repose specifies the angle of repose for Bulk_cargo (see 4.2.8).

4.2.27.2 bulk_cargo_mass

The bulk_cargo_mass specifies the mass of the Bulk_cargo (see 4.2.8) that is supposed to be carried in the Compartment.

4.2.27.3 permeability

The permeability specifies the permeability of the Bulk_cargo (see 4.2.8).

4.2.27.4 top_of_hatch

The top_of_hatch specifies the height from baseline to the highest point of the hold including the hatchway.

4.2.28 Class_compartment_requirement_definition

A Class_compartment_requirement_definition is a type of Design_requirement (see 4.2.77) that describes properties of a Compartment (see 4.2.35) in general that are specifically required for performing hull design approval by rules. Each Class_compartment_requirement_definition is either a Class_bulk_load_requirement_definition (see 4.2.27) or a Class_tank_requirement_definition (see 4.2.31).

The data associated with a Class_compartment_requirement_definition are the following:

— ambient_temperature;

— cargo_density;

— cargo_height;

— coating;

— damage_waterline;

— defined_for;

— max_pressure;

— max_temperature;

— min_pressure;

— min_temperature.

4.2.28.1 ambient_temperature

The ambient_temperature specifies the indication whether the cargo shall be transported without air conditioning.

4.2.28.2 cargo_density

The cargo_density specifies the highest cargo density for ships with tanks for heavy liquid; otherwise, the stowage rate of bulk load, i.e., the total cargo capacity of the ship divided by the total hold volume.

4.2.28.3 cargo_height

The cargo_height specifies the filling height in case of liquid load; otherwise, the height from the baseline to the top of the hatch in case of bulk load.

4.2.28.4 coating

The coating specifies the indication whether the compartment is fully coated or not.

4.2.28.5 damage_waterline

The damage_waterline specifies the height from the baseline to the waterline in a damaged condition of the compartment.

4.2.28.6 defined_for

The defined_for specifies the Compartment (see 4.2.35) that the Class_compartment_requirement_definition shall be a definition for.

4.2.28.7 max_pressure

The max_pressure specifies the maximum pressure inside the compartment.

4.2.28.8 max_temperature

The max_temperature specifies the maximum temperature inside the compartment.

4.2.28.9 min_pressure

The min_pressure specifies the minimum pressure inside the compartment.

4.2.28.10 min_temperature

The min_temperature specifies the minimum temperature inside the compartment.

4.2.29 Class_deck_load_requirement_definition

A Class_deck_load_requirement_definition is a type of Design_requirement (see 4.2.77) that describes properties for deck loads that are specifically required for performing a hull design approval by rules.

The data associated with a Class_deck_load_requirement_definition are the following:

— grab_weight;

— stowage_height;

— stowage_rate;

— vehicle_load.

4.2.29.1 grab_weight

The grab_weight is optional and if present, specifies the maximum weight of grabs that shall be used for unloading of Cargo (see 4.2.12).

4.2.29.2 stowage_height

The stowage_height is optional and if present, specifies the maximum height of Cargo (see 4.2.12) that may be stowed on the deck.

4.2.29.3 stowage_rate

The stowage_rate is optional and if present, specifies the maximum density with which Cargo (see 4.2.12) may be stowed on the deck.

4.2.29.4 vehicle_load

The vehicle_load is optional and if present, specifies the maximum load that may be imposed by a vehicle.

4.2.30 Class_notation

A Class_notation is the notations given to the hull and machinery of a Ship (see 4.2.122) by the classification society as a result of its approval activities during the design, manufacture, and in-service maintenance of the Ship.

The data associated with a Class_notation are the following:

— approval_required_for_heavy_cargo;

— approval_required_for_oil_cargo;

— approval_required_loading_unloading_aground;

— approval_required_loading_unloading_grabs;

— class_notations_hull;

— class_notations_machinery;

— class_society;

— ice_class_notation;

— service_area;

— service_factor.

4.2.30.1 approval_required_for_heavy_cargo

The approval_required_for_heavy_cargo is optional and if present, specifies a flag indicating whether or not approval for special strengthening for heavy Cargoes (see 4.2.12) is necessary. These notations are valid for bulk carriers to indicate the distribution of loads across the Cargo holds.

The value of approval_required_for_heavy_cargo is one of the following:

— HC;

— HC_E;

— HC_EA.

NOTE - See 4.2.30.1.1 - 4.2.30.1.3 for the definition of each allowable value for approval_required_for_heavy_cargo.

4.2.30.1.1 HC

HC: strengthened for heavy Cargo. Heavy Bulk_cargo (see 4.2.8) may be unevenly distributed among the Cargo holds.

4.2.30.1.2 HC_E

HC_E: strengthened for heavy cargo. In addition to HC a non-homogeneous loading condition with empty holds on full draught is approved. The approved combination of empty holds is added to the notation

EXAMPLE - Holds 2.0, 3.0, and 5.0 are empty.

4.2.30.1.3 HC_EA

HC_EA: strengthened for heavy Cargo. Any Cargo hold may be empty at full draught. The approved combinations of empty holds are added to the notation.

EXAMPLE - Holds 2.0, 3.0, and 5.0 are empty.

4.2.30.2 approval_required_for_oil_cargo

The approval_required_for_oil_cargo specifies a flag indicating whether or not approval is required for the carriage of oil Cargoes.

4.2.30.3 approval_required_loading_unloading_aground

The approval_required_loading_unloading_aground specifies a flag indicating whether or not approval for loading and unloading aground is necessary.

4.2.30.4 approval_required_loading_unloading_grabs

The approval_required_loading_unloading_grabs specifies a flag indicating whether or not approval for loading and unloading using grabs is necessary.

4.2.30.5 class_notations_hull

The class_notations_hull specifies the notation given to the hull of the Ship (see 4.2.122) by the classification society as a result of its approval activities done on the hull.

4.2.30.6 class_notations_machinery

The class_notations_machinery specifies the notation given to the ship society as a result of its approval activities done on the machinery.

4.2.30.7 class_society

The class_society specifies the name and organizational details of the classification society whose rules and regulations are being used to assess the Ship (see 4.2.122).

4.2.30.8 ice_class_notation

The ice_class_notation is optional and if present, specifies the type of class notation given to the Ship (see 4.2.122) indicating the ice conditions in which the Ship has been approved to operate.

4.2.30.9 service_area

The service_area specifies describes the area or route in which the Ship (see 4.2.122) operates. This may include information about waterway, wave, weather and wind conditions.

4.2.30.10 service_factor

The service_factor is optional and if present, specifies the service area of the Ship (see 4.2.122) and the waves that occur in that area. The service_factor should be in the range of 0.5 to 1.0.

4.2.31 Class_tank_requirement_definition

A Class_tank_requirement_definition is a type of Class_compartment_requirement_definition (see 4.2.28) that describes properties for tanks that are specifically required for performing a hull design approval by rules.

The data associated with a Class_tank_requirement_definition are the following:

— free_surface_parameters;

— overflow_height;

— partial_filling;

— pressure_relief_setting.

4.2.31.1 free_surface_parameters

The free_surface_parameters is optional and if present, specifies the length and breadth of the free surface in the tank in this mentioned sequence, if there is any free surface.

4.2.31.2 overflow_height

The overflow_height specifies the maximum filling height in a tank just before overflow; this is also referred to as the top of the air pipe.

4.2.31.3 partial_filling

The partial_filling specifies the indication whether the compartment may be partially filled or not.

4.2.31.4 pressure_relief_setting

The pressure_relief_setting specifies the pressure under which the inert gas relief valve will open.

4.2.32 Coating

A Coating is the definition of the protective coating applied to the Ship (see 4.2.122) structure to protect it from corrosion from water or liquid Cargoes (see 4.2.12). Each Coating is either a Corrosion_control_coating (see 4.2.66), a Fire_safe_coating (see 4.2.86), or a Primer_coating (see 4.2.118).

The data associated with a Coating are the following:

— certification;

— description;

— dry_film_thickness;

— manufacturer;

— name;

— number_of_coats;

— surface_preparation.

4.2.32.1 certification

The certification specifies whether the coating, and all the given attributes, has been certified for the specified use by an organization such as a classification society.

4.2.32.2 description

The description specifies a brief description of the coating.

4.2.32.3 dry_film_thickness

The dry_film_thickness specifies the thickness of the coating film.

4.2.32.4 manufacturer

The manufacturer specifies the company that makes the coating.

4.2.32.5 name

The name specifies the trade name of the coating.

4.2.32.6 number_of_coats

The number_of_coats specifies the number of coats that must be applied to the surface.

4.2.32.7 surface_preparation

The surface_preparation specifies the codes used for the grade of preparation required for steel surfaces prior to application of coating. These are defined in ISO 8501-1.

The value of surface_preparation is one of the following:

— Sa1;

— Sa2;

— Sa2-1/2;

— Sa3;

— St2;

— St3;

— Fl.

NOTE - See 4.2.32.7.1- 4.2.32.7.7 for the definition of each allowable value for surface_preparation.

4.2.32.7.1 Sa1

Sa1: Light blast-cleaning.

4.2.32.7.2 Sa2

Sa2: Thorough blast-cleaning.

4.2.32.7.3 Sa2-1/2

Sa2-1/2: Very thorough blast-cleaning.

4.2.32.7.4 Sa3

Sa3: Blast-cleaning to visually clean steel.

4.2.32.7.5 St2

St2: Thorough hand and power tool cleaning.

4.2.32.7.6 St3

St3: Very thorough hand and power tool cleaning.

4.2.32.7.7 Fl

Fl: Flame cleaning.

4.2.33 Coating_certification

A Coating_certification is an identification of the organization and time limit on the certification of a Coating (see 4.2.32) for usage.

The data associated with a Coating_certification are the following:

— certifying_organisation;

— expiry_date.

4.2.33.1 certifying_organisation

The certifying_organisation specifies the organzation that certified the Coating for use.

4.2.33.2 expiry_date

The expiry_date specifies the time limit on the approval.

4.2.34 Coating_level

A Coating level is used for expressing the extent of Coating in a Compartment (see 4.2.35).

The data associated with a Coating_level are the following:

— lower_extent;

— upper_extent.

4.2.34.1 lower_extent

The lower_extent specifies the percentage of the height from the base of the Compartment to the lowest level of the Coating.

4.2.34.2 upper_extent

The upper_extent specifies the percentage of the height from the base of the Compartment to the highest level of the Coating.

4.2.35 Compartment

A Compartment is a type of Space (see 4.2.125) that is a physical subdivision of space on a ship, designed to hold dry or liquid cargo, fuel, water, passengers, crew, machinery, equipment, etc. Each Compartment may have one or more functional definitions to specify the intended function(s) of the Compartment as well as one or more design definitions, which specify the compartment geometric properties. Each Compartment may also have one or more Compartment_product structure_definitions, which reference the items bounding a compartment, such as structural panels, or enclosed by a compartment, such as structural parts, outfitting and equipment objects.

4.2.36 Compartment_abbreviated_name

A Compartment_abbreviated_name is a type of Compartment_naval_administrative_property (see 4.2.50) that specifies a short, compact, efficient reference to a particular Compartment (see 4.2.35) on a Ship (see 4.2.122).

The data associated with a Compartment_abbreviated_name are the following:

— name.

The name specifies a short, compact, efficient means of referring to a particular Compartment on a Ship. The abbreviated name may or may not have an embedded meaning.

NOTE - In Naval vessels, abbreviated names are commonly used and are encoded such that they indicate the type of cargo, and the vertical, transverse, and longitudinal position.

EXAMPLE - The abbreviation of 6-55-1-F for the freshwater tank above the sixth deck, beginning at frame 55, and located on the starboard side.

4.2.37 Compartment_acceleration

A Compartment_acceleration is a type of Compartment_naval_administrative_property (see 4.2.50) that is the acceleration of gravity of the Compartment while the ship is underway.

The data associated with a Compartment_acceleration are the following:

— acceleration_g_force.

The acceleration_g_force specifies a measure of the allowable acceleration force, expressed as a ratio compared to the acceleration of gravity, allowed for a compartment. This force is represented as a single value and governs the accelerations in all three principal directions (e.g., vertical, longitudinal, and transverse).

EXAMPLE - A value of 1.5 would represent one-and-a-half times the force of gravity (32.2 ft/sec2), or 48.3 ft per sec per sec.

4.2.38 Compartment_access_authorization

A Compartment_access_authorization is a type of Compartment_naval_administrative_property (see 4.2.50) that is an indication of a limit on allowed accessibility to a compartment based on naval rank.

The data associated with a Compartment_access_authorization are the following:

— authorization_classification;

— user_defined_value.

4.2.38.1 authorization_classification

The authorization_classification specifies a type of crew restriction placed on the use of the Compartment (see 4.2.35).

The value of authorization_classification is one of the following:

— officers_only;

— crew_only;

— restricted;

— unrestricted;

— user_defined.

NOTE - See 4.2.38.1.1- 4.2.38.1.5 for the definition of each allowable value for authorization classification.

4.2.38.1.1 officers_only

officers_only: the Compartment is designated for use by officers.

4.2.38.1.2 crew_only

crew_only: the Compartment is designated for use by crew.

4.2.38.1.3 restricted

restricted: the Compartment is designated as a restricted area.

4.2.38.1.4 unrestricted

unrestricted: the Compartment access is not limited to any particular group.

4.2.38.1.5 user_defined

user_defined: the use of the Compartment is defined by the user_defined_value attribute.

4.2.38.2 user_defined_value

The user_defined_value is optional and if present, specifies classification for the case of authorization_classification specified as USER_DEFINED.

4.2.39 Compartment_air_circulation_rate

A Compartment_air_circulation_rate is a type of General_compartment_property (see 4.2.92) that defines the volume of air changes for the Compartment (see 4.2.35) per unit of time.

The data associated with a Compartment_air_circulation_rate are the following:

— air_circulation_rate.

The air_circulation_rate specifies measure of the volume of air changes for the Compartment per unit of time.

NOTE - This value is used by applications performing HVAC load analyses.

4.2.40 Compartment_area_property

A Compartment_area_property is a type of General_compartment_property (see 4.2.92) that defines different types of area properties for a Compartment (see 4.2.35). Each Compartment_area_property is either a Compartment_horizontal_cross_sectional_area_property (see 4.2.47), Compartment_stiffened_surface_area_property (see 4.2.57), Compartment_unstiffened_surface_area_property (see 4.2.59), Compartment_vertical_longitudinal_cross_sectional_area_property (see 4.2.60), or a Compartment_vertical_transverse_cross_sectional_area_property (see 4.2.61).

4.2.41 Compartment_cargo_assignment

A Compartment_cargo_assignment is a type of Cargo_assignment (see 4.2.13). It is the allocation of a Cargo (see 4.2.12) to a Compartment (see 4.2.35) or Space (see 4.2.125) within a Ship (see 4.2.122). Each Compartment_cargo_assignment may be one of the following: a Bulk_cargo_assignment (see 4.2.9), a Liquid_cargo_assignment (see 4.2.103), or a Unit_cargo_assignment (see 4.2.150).

The data associated with a Compartment_cargo_assignment are the following:

— cargo;

— compartment.

4.2.41.1 cargo

The cargo specifies the type of Cargo that has been loaded.

4.2.41.2 compartment

The compartment specifies the Compartment into which the Cargo has been loaded.

4.2.42 Compartment_coating

A Compartment_coating is a type of General_compartment_property (see 4.2.92) that specifies the type of painting or Coating (see 4.2.32) required for a Compartment (see 4.2.35).

The data associated with a Compartment_coating are the following:

— corrosion_protection.

The corrosion_protection specifies a reference to the collection of properties for protecting Compartment internals and boundaries from corrosion.

4.2.43 Compartment_design_definition

A Compartment_design_definition is a type of Design_definition (see 4.2.76) that defines a version of a Compartment (see 4.2.35) from a design perspective.

The data associated with a Compartment_design_definition are the following:

— boundaries;

— defined_for;

— properties;

— representations.

4.2.43.1 boundaries

The boundaries specifies External_instance_references (see 4.2.84) to the AP216 Moulded_form Items or AP218 Structural_system Items that bound the Compartment.

4.2.43.2 defined_for

The defined_for specifies that a Compartment_design_definition is only valid for a Compartment.

4.2.43.3 properties

The properties specifies a collection of properties applicable to or derived from the design of a Compartment.

4.2.43.4 representations

The representations specifies that a Compartment_design_definition shall only have Compartment_shape_representations.

4.2.44 Compartment_design_requirement

A Compartment_design_requirement is a type of a Design_requirement (see 4.2.77) that defines a type of specification that represents a constraint placed on a design.

NOTE - These requirements could be in the form of a reference to a set of rules or formula, such as Design Specifications, Classification Society Rules, Welding Society Rules, etc. Or, it may be an explicit requirement, such as an electrical requirement for 110 volt power, an HVAC requirement for operating temperatures in the range of 50 degrees to 90 degrees Fahrenheit, etc.

The data associated with a Compartment_design_requirement are the following:

— defined_for;

— requirement_description;

— requirement_type.

4.2.44.1 defined_for

The defined_for specifies that a Compartment_design_requirement is only valid for a Space (see 4.2.125) or one of its subtypes, i.e., a Compartment (see 4.2.35) or Zone (see 4.2.164).

4.2.44.2 requirement_description

The requirement_description specifies a description of the requirement that is to be met.

4.2.44.3 requirement_type

The requirement_type specifies an indicator used to denote the source placing the design requirement on the Space. The source identifies the discipline or design function that governs some aspect of the design or operation of the Space.

The value of requirement_type is one of the following:

— naval_architecture;

— structural;

— piping;

— hvac;

— electrical;

— electronic;

— combat_system;

— outfit_furnishing;

— painting_coating;

— user_defined.

NOTE - See 4.2.44.3.1 - 4.2.44.3.10 for the definition of each allowable value for requirement_type.

4.2.44.3.1 naval_architecture

naval_architecture: the Compartment_design_requirement originates from the naval architecture discipline.

4.2.44.3.2 structural

structural: the Compartment_design_requirement originates from the structural discipline.

4.2.44.3.3 piping

piping: the Compartment_design_requirement originates from the piping discipline.

4.2.44.3.4 hvac

hvac: the Compartment_design_requirement originates from the hvac discipline.

4.2.44.3.5 electrical

electrical: the Compartment_design_requirement originates from the electrical discipline.

4.2.44.3.6 electronic

electronic: the Compartment_design_requirement originates from the electronic discipline.

4.2.44.3.7 combat_system

combat_system: the Compartment_design_requirement originates from the combat system discipline.

4.2.44.3.8 outfit_furnishing

outfit_furnishing: the Compartment_design_requirement originates from the outfitting and furnishings discipline.

4.2.44.3.9 painting_coating

painting_coating: the Compartment_design_requirement originates from the painting or coating discipline.

4.2.44.3.10 user_defined

user_defined: the Compartment_design_requirement originates from some other source than one of the specified design disciplines.

4.2.45 Compartment_functional_definition

A Compartment_functional_definition is a type of Functional_definition (see 4.2.89) that defines the functional role of a Compartment (see 4.2.35); the role may be a pre-defined one that corresponds to the intended use of the Compartment or may be a user-defined one.

The data associated with a Compartment_functional_definition are the following:

— defined_for;

— used_for.

4.2.45.1 defined_for

The defined_for specifies that a Compartment_functional_definition is only valid for a Compartment.

4.2.45.2 used_for

The used_for specifies the intended use of a Compartment. The pre-defined functions correspond to either a general compartment use, such as a cargo_compartment, or a specialised function such as dry_unit_cargo. The user_defined value allows identification of a type not specified by one of the pre-defined values.

The value of used_for is one of the following:

— cargo_compartment;

— dry_bulk_cargo_compartment;

— dry_unit_cargo_compartment;

— liquid_cargo_compartment;

— gaseous_cargo_compartment;

— habitable_compartment;

— berthing_compartment;

— cabin;

— control;

— passageway;

— medical;

— lounge;

— access_trunk;

— machinery_compartment;

— main_engine_room;

— auxiliary_engine_room;

— bow_thruster_room;

— equipment_room;

— tank;

— ballast_water_tank;

— oil_fuel_tank;

— potable_water_tank;

— waste_tank;

— jet_fuel_tank;

— void;

— cofferdam;

— trunk;

— shaft_alley;

— user_defined.

NOTE - See 4.2.45.2.1 - 4.2.45.2.29 for the definition of each allowable value for used_for.

4.2.45.2.1 cargo_compartment

cargo_compartment: the Compartment is designed to carry liguid, bulk, or containerized goods. These goods may be consumed during the voyage, as in the case of food or fuel, or they may be temporarily stored for transport between ports.

NOTE - a tank_compartment may also be used for the storage or transportation of liquid cargo.

4.2.45.2.2 dry_bulk_cargo_compartment

dry_bulk_cargo_compartment: the Compartment is designed to carry dry bulk cargo.

4.2.45.2.3 dry_unit_cargo_compartment

dry_unit_cargo_compartment: the Compartment is designed to carry dry unit cargo.

4.2.45.2.4 liquid_cargo_compartment

liquid_cargo_compartment: the Compartment is designed to carry liquid cargo.

4.2.45.2.5 gaseous_cargo_compartment

gaseous_cargo_compartment: the Compartment is designed to carry gaseous cargo.

4.2.45.2.6 habitable_compartment

habitable_compartment: the Compartment is designed as a habitable space, which is primarily designated as suitable for occupancy by humans. Passenger safety and comfort are subject to international, national, class_society, or other regulations usually covered by product specifications and applicable class and register notations.

4.2.45.2.7 berthing_compartment

berthing_compartment: the Compartment is designed to be used as berthing space.

4.2.45.2.8 cabin

cabin: the Compartment is designed to be used as cabin space.

4.2.45.2.9 control

control: the Compartment is designed to be used for ship command and control functions.

4.2.45.2.10 passageway

passageway: the Compartment is designed to be used as a passageway.

4.2.45.2.11 medical

medical: the Compartment is designed to be used as a medical space.

4.2.45.2.12 lounge

lounge: the Compartment is designed to be used as a lounge space.

4.2.45.2.13 access_trunk

access_trunk: the Compartment is designed to be used as an access trunk.

4.2.45.2.14 machinery_compartment

machinery_compartment: the Compartment is designed to contain machinery for the operation of the ship or in support of the vessel mission.

EXAMPLE - the Engine room and bow thruster room are types of machinery_compartments.

4.2.45.2.15 main_engine_room

main_engine_room: the Compartment is designed to be used as the main engine room.

4.2.45.2.16 auxiliary_engine_room

auxiliary_engine_room: the Compartment is designed to be used as an auxiliary engine room space.

4.2.45.2.17 bow_thruster_room

bow_thruster_room: the Compartment is designed to be used as the bow thruster room.

4.2.45.2.18 equipment_room

equipment_room: the Compartment is designed to be used as a general equipment room.

4.2.45.2.19 tank

tank: the Compartment is designed to carry liquids used in the mission of the ship, or for the storage of liquid cargoes transported by the ship.

EXAMPLE - Fuels for propulsion of the ship, potable water for the passengers and crew, waste products, petroleum product cargo, and fuel for aircraft supported by the ship are carried in tank_compartments.

4.2.45.2.20 ballast_water_tank

ballast_water_tank: the Compartment is designed to carry ballast water.

4.2.45.2.21 oil_fuel_tank

oil_fuel_tank: the Compartment is designed to carry oil or fuel.

4.2.45.2.22 potable_water_tank

potable_water_tank: the Compartment is designed to carry potable water.

4.2.45.2.23 waste_tank

waste_tank: the Compartment is designed to carry waste.

4.2.45.2.24 jet_fuel_tank

jet_fuel_tank: the Compartment is designed to carry jet fuel.

4.2.45.2.25 void

void: the Compartment is designed as an inaccessible, closed space that is never used to carry cargo or to be occupied by humans or to install any machinery or equipment in it. The main purpose of a void compartment is segregating the cargo and or fluids, which are necessary to operate the ship, and to create space for emergency access to other spaces.

4.2.45.2.26 cofferdam

cofferdam: the Compartment is designed to be used as a cofferdam.

4.2.45.2.27 trunk

trunk: the Compartment is designed to be used as a trunk.

4.2.45.2.28 shaft_alley

shaft_alley: the Compartment is designed to be used as a shaft alley.

4.2.45.2.29 user_defined

user_defined: the Compartment function is other than one of the pre-defined values and is specified by the user_def_function attribute.

4.2.46 Compartment_group

A Compartment_group is a definition of the Compartment (see 4.2.35) and its associated volume that has been used in Tonnage_measurement (see 4.2.146) calculations.

The data associated with a Compartment_group are the following:

— compartment;

— tonnage_volume.

4.2.46.1 Compartment

The compartment specifies the group of Compartments that were used in the Tonnage_measurement calculation.

4.2.46.2 tonnage_volume

The tonnage_volume specifies the volume of the Compartment that was used for the Tonnage_measurement calculation.

4.2.47 Compartment_horizontal_cross_sectional_area_property

A Compartment_horizontal_cross_sectional_area_property is a type of Compartment_area_property (see 4.2.40) that represents a two dimensional cross-sectional area for a Compartment (see 4.2.35), required to accomodate design requirements on the Compartment, such as placement of equipment.

The data associated with a Compartment_horizontal_cross_sectional_area_property are the following:

— horizontal_cross_sectional_area.

The horizontal_cross_sectional_area specifies an area measurement on a plane parallel to the baseline plane.

NOTE - Typically, the area is used to reserve space early in the design process, such as the area needed for placement of a propulsion system footprint (i.e., main engine, reduction gear, etc.).

4.2.48 Compartment_illumination

A Compartment_illumination is a type of General_compartment_property (see 4.2.92) that defines the lighting requirements for a Compartment (see 4.2.35).

The data associated with a Compartment_illumination are the following:

— illumination_value.

The illumination_value specifies amount of lighting required for a Compartment.

NOTE - this value is used by applications in performing lighting analysis.

4.2.49 Compartment_insulation

A Compartment_insulation is a type of Compartment_naval_administrative_property (see 4.2.50) that identifies the type of thermal insulation required for a Compartment (see 4.2.35).

The data associated with a Compartment_insulation are the following:

— insulation_category;

— user_defined_value.

4.2.49.1 insulation_category

The insulation_category specifies an indicator used to denote what type of thermal insulation is to be applied to compartment boundaries to reduce the rate of heat transfer to or from heated, ventilated, and air-conditioned spaces; to reduce condensation; and to retard excessive temperature rise in the event of fire in adjacent spaces. Thermal insulation may be installed in conjunction with antisweat treatments to reduce condensation, and to serve as a vapor barrier to

prevent the insulation from absorbing condensation. The value of insulation_category is one of the following:

— A;

— B;

— C;

— D;

— E;

— F;

— G;

— H;

— I;

— J;

— K;

— L;

— M;

— N;

— O;

— P;

— Q;

— R;

— user_defined.

NOTE - See 4.2.49.1.1 - 4.2.49.1.19 for the definition of each allowable value for insulation_category.

4.2.49.1.1 A

A: Fibrous-glass faced thermal insulation board,

NOTE: Fibrous-glass faced thermal insulation board in accordance with MIL-I-742 [8], Type I.

4.2.49.1.2 B

B: Fibrous-glass unfaced thermal felt.

NOTE: Fibrous-glass unfaced therma felt in accordance with MIL-I-22023 [7], Type I, Class 6.

4.2.49.1.3 C

C: Fibrous-glass faced thermal and sound absorbing felt.

NOTE: Fibrous-glass faced thermal and sound absorbing felt in accordance with MIL-I-22023 [7], Type III.

4.2.49.1.4 D

D: Sheathing, consisting of perforated aluminum.

NOTE: Sheathing, consisting of perforated aluminum in accordance with MIL-S-12875 [10], Type II, Class B.

4.2.49.1.5 E

E: Fibrous-glass tape.

NOTE: Fibrous-glass tape in accordance with MIL-C-20079 [6], Type II, Class I.

4.2.49.1.6 F

F: Latex adhesive.

NOTE: Latex adhesive in accordance with MIL-A-3316 [5], Class I, Grade A.

4.2.49.1.7 G

G: Epoxy adhesive.

NOTE: Epoxy adhesive in accordance with MIL-A-24456 [4].

4.2.49.1.8 H

H: Aluminum alloy stud.

NOTE: Aluminum alloy stud in accordance with MIL-S-24149/2 [11], Type III, Class 3, with compatible aluminum press-fit cap as shown on NAVSEA drawing 804-5773931[12].

4.2.49.1.9 I

I: Carbon steel stud.

NOTE: Carbon steel stud in accordance with MIL-S-24149/1 [11], Type VI, Class 3, with compatible carbon steel press-fit cap.

4.2.49.1.10 J

J: Aluminum alloy or steel spacers.

4.2.49.1.11 K

K: Adhesive-attached studs.

NOTE: Adhesive-attached studs, in general accordance with MIL-S-24149 [11], except that the studs are welded to a perforated metal baseplate, at least two inches square, of the same metal as the stud.

4.2.49.1.12 L

L: Elastomeric foam.

NOTE: Elastomeric foam in accordance with MIL-P-15280 [9], Form S.

4.2.49.1.13 M

M: Adhesive for securing polyimide foam thermal insulation panels.

NOTE: Adhesive in accordance with MIL-A-24179 [3].

4.2.49.1.14 N

N: Polyimide foam faced thermal insulation panel.

NOTE: Polyimide foam faced thermal insulation panel in accordance with DOD-I-24688 [1], Type II, Class 1.

4.2.49.1.15 O

O: Closed cell foam.

NOTE: Closed cell foam meeting the requirements of SEAWOLF Class Project Peculiar Document No. 802-6335737 [13], such as closed cell polyimide foam.

4.2.49.1.16 P

P: Polyimide foam.

NOTE: Polyimide foam, type CC306-KCF, manufactured by Reilly Benton Co., (a material known to meet the requirements of material O above), or equal.

4.2.49.1.17 Q

Q: Fibrous-glass.

NOTE: Fibrous-glass, type HIMS, manufactured by Manville Corp., (a material known to meet the requirements of material O above), or equal.

4.2.49.1.18 R

R: Acrylic tape.

NOTE: Acrylic tape, 3M Y9485, or equal.

4.2.49.1.19 user_defined

user_defined: the insulation_category of the Compartment is defined by a user specified value.

4.2.49.2 user_defined_value

The user_defined_value is optional and if present, specifies the description for the USER_DEFINED insulation_category.

4.2.50 Compartment_naval_administrative_property

A Compartment_naval_administrative_property is a type of Compartment_property (see 4.2.54) that represents a collection of identification and Compartment (see 4.2.35) design parameters that are applicable only to the design of Naval vessels. Each Compartment_naval_administrative_property may be one of the following: a Compartment_abbreviated_name (see 4.2.36), a Compartment_acceleration (see 4.2.37), a Compartment_access_authorization (see 4.2.38), a Compartment_insulation (see 4.2.49), a Compartment_noise_category (see 4.2.51), a Compartment_nuclear_classification (see 4.2.52), a Compartment_safety_class (see 4.2.55), a Compartment_security_classification (see 4.2.52), or a Compartment_ziplist_number (see 4.2.64).

4.2.51 Compartment_noise_category

A Compartment_noise_category is a type of Compartment_naval_administrative_property (see 4.2.50) that defines the design requirements for the internal level of sound of a Compartment (see 4.2.35).

The data associated with a Compartment_noise_category are the following:

— noise_category;

— user_defined_value.

4.2.51.1 noise_category

The noise_category specifies a single alphabetical character key used to denote whether special consideration is to be given to the Compartment with respect to the internal level of sound.

The value of noise_category is one of the following:

— A;

— B;

— C;

— D;

— E;

— F;

— user_defined.

NOTE - See 4.2.51.1.1 - 4.2.51.1.7 for the definition of each allowable value for noise_category.

4.2.51.1.1 A

A: the Compartment shall be designed for intelligible speech-low noise.

4.2.51.1.2 B

B: the Compartment shall be designed for comfort.

4.2.51.1.3 C

C: the Compartment shall be designed for quiet.

4.2.51.1.4 D

D: the Compartment shall be designed for deafness avoidance.

4.2.51.1.5 E

E: the Compartment shall be designed for intelligible speech-high noise.

4.2.51.1.6 F

F: the Compartment shall be designed for intelligible speech-topside.

4.2.51.1.7 user_defined

user_defined: the noise_category of the Compartment is defined by a user specified value.

4.2.51.2 user_defined_value

The user_defined_value is optional and if present, specifies the description for the USER_DEFINED noise_category.

4.2.52 Compartment_nuclear_classification

A Compartment_nuclear_classification is a type of Compartment_naval_administrative_property (see 4.2.50) that specifies whether a Compartment (see 4.2.35) is designated as containing nuclear reactors or is used for storage or repair of nuclear weapons; otherwise the Compartment is classified as non-nuclear.

The data associated with a Compartment_nuclear_classification are the following:

— nuclear_classification.

The nuclear_classification specifies an indicator used to denote whether the Compartment is designated a nuclear or non-nuclear space. This designation applies to spaces specifically designed to contain such things as nuclear reactors as well as spaces used for the storage or repair of nuclear weapons.

The value of nuclear_classification is one of the following:

— nuclear;

— non_nuclear.

NOTE - See 4.2.52.1.1 - 4.2.52.1.2 for the definition of each allowable value for nuclear_classification.

4.2.52.1.1 nuclear

nuclear: the Compartment contains nuclear propulsion systems or is used for storage or repair of nuclear weapons.

4.2.52.1.2 non_nuclear

non_nuclear: the Compartment does not contain nuclear propulsion systems nor is it used for storage or repair of nuclear weapons.

4.2.53 Compartment_occupancy

A Compartment_occupancy is a type of General_compartment_property (see 4.2.92) that specifies the design requirements for the number of people that are permitted to occupy a Compartment (see 4.2.35).

The data associated with a Compartment_occupancy are the following:

— occupancy.

The occupancy specifies the number of humans that are permitted to occupy a Compartment simultaneously.

4.2.54 Compartment_property

A Compartment_property is a collection of properties for a Compartment (see 4.2.35). A property is a measure of some significant characteristic of a Compartment associated with a specific context. The contexts may be either maximum, minimum, estimated, calculated, or measured. Each Compartment_property is either a Cargo_compartment_property (see 4.2.15), a Compartment_naval_administrative_property (see 4.2.50), a General_compartment_property (see 4.2.92), or a Tank_compartment_property (see 4.2.142).

The data associated with a Compartment_property are the following:

— contxt.

The contxt specifies an indicator used to associate a design meaning with a compartment property. The maximum and minimum contexts serve to define the design limits for the property, while the estimated, calculated, and measured contexts associate a degree of accuracy for the property value.

The value of contxt is one of the following:

— maximum;

— minimum;

— estimated;

— calculated;

— measured.

NOTE - See 4.2.54.1.1 - 4.2.54.1.5 for the definition of each allowable value for contxt.

4.2.54.1.1 maximum

maximum: the Compartment_property specifies the maximum design values for the property.

4.2.54.1.2 minimum

minimum: the Compartment_property specifies the minimum design values for the property.

4.2.54.1.3 estimated

estimated: the Compartment_property specifies the estimated design value for the property.

4.2.54.1.4 calculated

calculated: the Compartment_property specifies the calculated design value for the property.

4.2.54.1.5 measured

measured: the Compartment_property specifies the measures as-built value for the property.

4.2.55 Compartment_safety_class

A Compartment_safety_class is a type of Compartment_naval_administrative_property (see 4.2.50) that specifies the safety classification of a Compartment (see 4.2.35) with regards to a hazardous working environment for humans.

The data associated with a Compartment_safety_class are the following:

— safety_category;

— user_defined_value.

4.2.55.1 safety_category

The safety_category specifies an indicator used to denote special consideration for the compartment with regard to a hazardous working environment for humans.

The value of safety_category is one of the following:

— A;

— B;

— C;

— user_defined.

NOTE - See 4.2.55.1.1 - 4.2.55.1.4 for the definition of each allowable value for safety_category.

4.2.55.1.1 A

A: the Compartment is designated as safety class A.

4.2.55.1.2 B

B: the Compartment is designated as safety class B.

4.2.55.1.3 C

C: the Compartment is designated as safety class C.

4.2.55.1.4 user_defined

user_defined: the safety class is defined by a user-specified value.

4.2.55.2 user_defined_value

The user_defined_value is optional and if present, specifies the description for the USER_DEFINED safety_category.

4.2.56 Compartment_security_classification

A Compartment_security_classification is a type of Compartment_naval_administrative_property (see 4.2.50) that specifies the security requirements of a Compartment (see 4.2.35) with regards to personnel accessibility and security clearances.

The data associated with a Compartment_security_classification are the following:

— security_classification;

— user_defined_value.

4.2.56.1 security_classification

The security_classification specifies an indicator used to denote special considerations for the Compartment with respect to accessibility and security clearances.

The value of security_classification is one of the following:

— unclassified;

— classified;

— secret;

— user_defined.

NOTE - See 4.2.56.1.1 - 4.2.56.1.4 for the definition of each allowable value for security_classification.

4.2.56.1.1 unclassified

unclassified: the Compartment is designated for unclassified access.

4.2.56.1.2 classified

classified: the Compartment is designated for access only by persons with classified-level security clearance.

4.2.56.1.3 secret

secret: the Compartment is designated for access only by persons with secret-level security clearance.

4.2.56.1.4 user_defined

user_defined: the security classification is defined by a user-specified value.

4.2.56.2 user_defined_value

The user_defined_value is optional and if present, specifies the description for the USER_DEFINED security_classification.

4.2.57 Compartment_stiffened_surface_area_property

A Compartment_stiffened_surface_area_property is a type of Compartment_area_property (see 4.2.40) that specifies a measure of the amount of surface area for the compartment including the surface area of any interior stiffeners on the bulkheads, decks, hull shell, etc.

NOTE - the stiffened_surface_area is used to estimate amount of coating materials to be applied to the compartment surfaces and the attached stiffeners, such as primer or paint.

The data associated with a Compartment_stiffened_surface_area_property are the following:

— stiffened_surface_area.

The stiffened_surface_area specifies the value of the stiffened surface area.

4.2.58 Compartment_tightness

A Compartment_tightness is a type of General_compartment_property (see 4.2.92) that is an indicator as to the degree of tightness (i.e., the ability to prevent the passage of air and/or liquid) required of all bulkheads forming the boundary of the Compartment (see 4.2.35).

The data associated with a Compartment_tightness are the following:

— required_bulkhead_tightness;

— user_defined_value.

4.2.58.1 required_bulkhead_tightness

The required_bulkhead_tightness specifies an indicator of the ability to prevent the passage of air and or liquid for all bulkheads forming the Compartment

The value of required_bulkhead_tightness is one of the following:

— air_tight;

— fume_tight;

— water_tight;

— oil_tight;

— non_tight;

— expanded_metal;

— user_defined.

NOTE - See 4.2.58.1.1 - 4.2.58.1.7 for the definition of each allowable value for required_bulkhead_tightness.

4.2.58.1.1 air_tight

air_tight: the Compartment boundaries shall be designed to prevent the passage of air.

4.2.58.1.2 fume_tight

fume_tight: the Compartment boundaries shall be designed to prevent the passage of fumes.

4.2.58.1.3 water_tight

water_tight: the Compartment boundaries shall be designed to prevent the passage of water.

4.2.58.1.4 oil_tight

oil_tight: the Compartment boundaries shall be designed to prevent the passage of oil.

4.2.58.1.5 non_tight

non_tight: the Compartment boundaries shall not be closed to prevent the passage of air, oil, water, or fumes.

4.2.58.1.6 expanded_metal

expanded_metal: the Compartment boundaries may consist of expanded metal mesh and therefore will not be closed to prevent the passage of air, oil, water, or fumes.

4.2.58.1.7 user_defined

user_defined: the required_bulkhead_tightness is defined by a user-specified value.

4.2.58.2 user_defined_value

The user_defined_value is optional and if present, specifies the description for the USER_DEFINED required_bulkhead_tightness.

4.2.59 Compartment_unstiffened_surface_area_property

A Compartment_unstiffened_surface_area_property is a type of Compartment_area_property (see 4.2.40) that specifies a measure of the amount of surface area for the Compartment (see 4.2.35) excluding the surface area of any interior stiffeners on the bulkheads, decks, hull shell, etc.

NOTE - the unstiffened_surface_area is used to estimate amount of coating materials to be applied to compartment surfaces but not the attached stiffeners, such as insulation.

The data associated with a Compartment_unstiffened_surface_area_property are the following:

— unstiffened_surface_area.

The unstiffened_surface_area specifies the value of the unstiffened surface area.

4.2.60 Compartment_vertical_longitudinal_cross_sectional_-area_property

A Compartment_vertical_longitudinal_cross_sectional_area_property is a type of Compartment_area_property (see 4.2.40) that specifies a two dimensional cross-sectional area for a Compartment (see 4.2.35), required to accomodate design requirements on the Compartment, such as placement of equipment.

The data associated with a Compartment_vertical_longitudinal_cross_sectional_area_property are the following:

— vertical_longitudinal_cross_sectional_area.

The vertical_longitudinal_cross_sectional_area specifies an area measurement corresponding to a plane defined by the vertical and longitudinal axes.

NOTE - typically, this area is used to reserve space early in the design process, such as the area needed for placement of a large piece of equipment.

4.2.61 Compartment_vertical_transverse_cross_sectional_-area_property

A Compartment_vertical_transverse_cross_sectional_area_property is a type of Compartment_area_property (see 4.2.40) that specifies a two dimensional cross-sectional area for a Compartment, required to accomodate design requirements on the Compartment (see 4.2.35).

The data associated with a Compartment_vertical_transverse_cross_sectional_area_property are the following:

— vertical_transverse_cross_sectional_area.

The vertical_transverse_cross_sectional_area specifies an area measurement corresponding to a plane defined by the vertical and transverse axes.

NOTE - typically, this area is used to reserve space early in the design process, such as the area needed for placement of a large piece of equipment.

4.2.62 Compartment_volume_permeability_property

A Compartment_volume_permeability_property is a type of General_compartment_property (see 4.2.92). It specifies a measure, expressed as a percentage, of the volume of the Compartment (see 4.2.35) representing open space (i.e., not occupied by equipment, structure, machinery, etc.) that would flood in the event the space watertight integrity was damaged. This is a key parameter for the damage stability calculations for a ship.

The data associated with a Compartment_volume_permeability_property are the following:

— permeability.

The permeability specifies the percentage of the total volume of a Compartment that is not occupied by the ship structure, systems, or permanently attached outfitting and furnishing objects.

4.2.63 Compartment_volume_property

A Compartment_volume is a type of General_compartment_property (see 4.2.92) that describes the volumetric properties of a Compartment (see 4.2.35).

The data associated with a Compartment_volume_property are the following:

— centre_of_volume;

— volume.

4.2.63.1 centre_of_volume

The centre_of_volume specifies the centre of volume of a Compartment in relation to the global co-ordinate system of the ship.

4.2.63.2 volume

The volume specifies the enclosed volume of a Compartment.

4.2.64 Compartment_ziplist_number

A Compartment_ziplist_number is a type of Compartment_naval_administrative_property (see 4.2.50) that specifies an organization-specific identifier used for departmental or divisional control over a Compartment (see 4.2.35) during an overhaul or repair availability.

The data associated with a Compartment_ziplist_number are the following:

— department_ziplist_number;

— division_ziplist_number.

4.2.64.1 department_ziplist_number

The division_ziplist_number specifies an organization-specific identifier used for departmental control over the compartment during an overhaul or repair availability.

4.2.64.2 division_ziplist_number

The division_ziplist_number specifies an organization-specific identifier used for divisional control over the compartment during an overhaul or repair availability.

4.2.65 Compensated_gross_tonnage

A Compensated_gross_tonnage is a value for Gross_tonnage (see 4.2.95), which reflects the complexity of the work involved in the construction of the Ship (see 4.2.122).

The data associated with a Compensated_gross_tonnage are the following:

— compensation_factor;

— gross_tonnage_measurement;

— tonnage_value.

4.2.65.1 compensation_factor

The compensation_factor specifies the multiplication factor applied to the Gross_tonnage value in order to obtain the Compensated_gross_tonnage. The compensation_factor is derived by the Association of West European Shipyards and the Shipbuilding Association of Japan. It varies according to the type of Ship, deadweight (for cargo ships), and Gross_tonnage (for passenger ships). For any particular Ship type, the compensation factor decreases with increasing Ship size.

EXAMPLE - the larger the ship, the smaller the man-hour-requirement per gross tonnage.

4.2.65.2 gross_tonnage_measurement

The gross_tonnage_measurement specifies the Gross_tonnage measurement that the compensated figure is based on.

4.2.65.3 tonnage_value

The tonnage_value specifies the value of the compensated gross tonnage resulting from the multiplication of the gross tonnage measurement by the compensation factor.

4.2.66 Corrosion_control_coating

A Corrosion_control_coating is a type of Coating (see 4.2.32) that specifies the coatings to be applied to a Compartment (see 4.2.35) to prevent corrosion of the metal due to contact with the environmental elements or with a Cargo (see 4.2.12).

The data associated with a Corrosion_control_coating are the following:

— applicability;

— primer;

— type_of.

4.2.66.1 applicability

The applicability specifies the circumstances where the coating is to be used.

The value of applicability is one of the following:

— C;

— RS;

— B;

— V.

NOTE - See 4.2.66.1.1 - 4.2.66.1.4 for the definition of each allowable value for applicability.

4.2.66.1.1 C

C: Suitable for crude oil.

4.2.66.1.2 RS

RS: Suitable for refined spirits.

4.2.66.1.3 B

B: Suitable for ballast water.

4.2.66.1.4 V

V: Suitable for void spaces.

4.2.66.2 primer

The primer specifies the Primer_coating (see 4.2.118) that is required by the Corrosion_control_coating.

4.2.66.3 type_of

The type_of specifies the chemical compound used to coat the hull structure.

The value of type_of is one of the following:

— aluminium;

— bituminous;

— chlorinated_rubber;

— coal_tar;

— epoxy;

— glassflake;

— isocynate;

— micaceous_iron_oxide;

— non_oxidising;

— phenolic;

— pitch;

— polyester;

— polyurethane;

— tar;

— vinyl;

— water_based;

— zinc_rich;

— zinc_silicate.

NOTE - See 4.2.66.3.1 - 4.2.66.3.18 for the definition of each allowable value for type_of.

4.2.66.3.1 aluminium

aluminium: the Coating is aluminium.

4.2.66.3.2 bituminous

bituminous: the Coating is bituminous.

4.2.66.3.3 chlorinated_rubber

chlorinated_rubber: the Coating is chlorinated rubber.

4.2.66.3.4 coal_tar

coal_tar: the Coating is coal tar.

4.2.66.3.5 epoxy

epoxy: the Coating is epoxy.

4.2.66.3.6 glassflake

glassflake: the Coating is glassflake.

4.2.66.3.7 isocynate

isocynate: the Coating is isocynate.

4.2.66.3.8 micaceous_iron_oxide

micaceous_iron_oxide: the Coating is micaceous iron oxide.

4.2.66.3.9 non_oxidising

non_oxidising: the Coating is of a non-oxidising type.

4.2.66.3.10 phenolic

phenolic: the Coating is phenolic.

4.2.66.3.11 pitch

pitch: the Coating is pitch.

4.2.66.3.12 polyester

polyester: the Coating is polyester.

4.2.66.3.13 polyurethane

polyurethane: the Coating is polyurethane.

4.2.66.3.14 tar

tar: the Coating is tar.

4.2.66.3.15 vinyl

vinyl: the Coating is vinyl.

4.2.66.3.16 water_based

water_based: the Coating is water-based.

4.2.66.3.17 zinc_rich

zinc_rich: the Coating is zinc rich.

4.2.66.3.18 zinc_silicate

zinc_silicate: the Coating is zinc silicate.

4.2.67 Corrosion_protection

A Corrosion_protection is a description of properties for protecting Compartment (see 4.2.35) internals and boundaries from corrosion.

The data associated with a Corrosion_protection are the following:

— cathodic_protection;

— coating_height;

— coating_material.

4.2.67.1 cathodic_protection

The cathodic_protection specifies flags whether cathodic corrosion protection is applicable or not.

4.2.67.2 coating_height

The coating_height specifies the range of the Coating (see 4.2.32) thicknesses of the Compartment.

EXAMPLE - a tank would be coated from 80 to 90.

4.2.67.3 coating_material

The coating_material specifies the material that is to be used to coat the metal making up the Compartment boundaries.

4.2.68 Damage_case

A Damage_case is a representation of the state of the Ship (see 4.2.122) when it has sustained damage. The state is defined by the Loading_condition_definitions (see 4.2.104) of the Ship before damage occured, the Compartments (see 4.2.35) that have been damaged, and the associated Stability_property (see 4.2.139).

The data associated with a Damage_case are the following:

— damage_cause;

— damaged_compartments;

— original_loads;

— position_of_damage;

— relative_damage_position;

— user_defined.

4.2.68.1 damage_cause

The damage_cause specifies the type of incident that has caused the damage to the associated Compartments.

The value of damage_cause is one of the following:

— collision;

— grounding;

— explosion;

— user_defined.

NOTE - See 4.2.68.1.1 - 4.2.68.1.4 for the definition of each allowable value for damage_cause.

4.2.68.1.1 collision

collision: an impact of the hull of the Ship with some other object.

4.2.68.1.2 grounding

grounding: an impact of the hull of the Ship with the sea bed.

4.2.68.1.3 explosion

explosion: a violent combustion of material resulting in a force impacting upon the hull of the Ship or internal Compartments.

4.2.68.1.4 user_defined

user_defined: a cause of damage to the hull of the Ship, not covered by the other options.

4.2.68.2 damaged_compartments

The damaged_compartments specifies a definition of the damaged Compartments. Each definition provides the properties and related specification data for permeability, volume, capacity, etc. for the Compartment.

4.2.68.3 original_loads

The original_loads specifies a definition describing the relationship between the Compartments, the Cargo (see 4.2.12), and the original Floating_position (see 4.2.87) of the Ship for a given Deadweight (see 4.2.72). The condition can be either for the design or the operation of the Ship.

4.2.68.4 position_of_damage

The position_of_damage specifies a reference point within the Ship of where the centre of the damage is believed to be. The data associated with this information is a qualifier to state whether this is an estimate or known fact.

4.2.68.5 relative_damage_position

The relative_damage_position specifies a simple indication of whether the damage sustained is above the waterline, below the waterline, or on the waterline. This provides an early indication of whether the Compartments affected are likely to become filled with water or not. If the damage is below the waterline, then it can be assumed that the Compartment will become flooded to the maximum extent possible.

The value of relative_damage_position is one of the following:

— above_waterline;

— on_waterline;

— below_waterline.

NOTE - See 4.2.68.5.1 - 4.2.68.5.3 for the definition of each allowable value for relative_damage_position.

4.2.68.5.1 above_waterline

above_waterline: the damage is centred above the current waterline.

4.2.68.5.2 on_waterline

on_waterline: the damage is centred on the current waterline.

4.2.68.5.3 below_waterline

below_waterline: the damage is centred below the current waterline.

4.2.68.6 user_defined

The user_defined is optional and if present, specifies a text string to identify causes of damage not enumerated by the Damage_type.

4.2.69 Damage_position

A Damage_position is a reference point within the Ship (see 4.2.69) of where the centre of the damage is believed to be. The data associated with this information is a qualifier to state whether this is an estimate or known fact.

The data associated with a Damage_position are the following:

— centre_of_damage;

— position_accuracy.

4.2.69.1 centre_of_damage

The centre_of_damage specifies a reference for the centre of the damage.

4.2.69.2 position_accuracy

The position_accuracy specifies a qualifier to state whether this is an estimate or an actual known fact.

The value of position_accuracy is one of the following:

— estimate;

— actual.

NOTE - See 4.2.69.2.1 - 4.2.69.2.2 for the definition of each allowable value for position_accuracy.

4.2.69.2.1 estimate

estimate: an estimated guess for the position

4.2.69.2.2 actual

actual: the actual known position

4.2.70 Damage_stability_definition

A Damage_stability_definition is a type of Stability_definition (see 4.2.136) that defines the stability properties for a given Ship (see 4.2.122) having been damaged. The results are defined in a tabular form for a given set of loading and damaged conditions, the associated Floating_positions (see 4.2.87), and represents the righting arms and the centre of buoyancy for the heel angles attained through the damage inflicted on the Ship.

The data associated with a Damage_stability_definition are the following:

— defined_for;

— extent_of_damage;

— representations.

4.2.70.1 defined_for

The defined_for specifies the Ship for which the Damage_stability_definition is defined.

4.2.70.2 extent_of_damage

The extent_of_damage specifies a representation of the Ship in a damaged state. This information includes the Loading_condition_definitions (see 4.2.104) of the Ship before damage occured, those Compartments (see 4.2.35) that have been damaged, and the associated Stability_property (see 4.2.139).

4.2.70.3 representations

The representations specifies the Stability_table (see 4.2.140) that represents the Ship in the damaged state.

4.2.71 Dangerous_goods_code

The Dangerous_goods_code identifies the nature of the danger associated with a specific Cargo (see 4.2.12).

The data associated with a Dangerous_goods_code are the following:

— class;

— subsidiary_risks.

4.2.71.1 class

The class specifies the primary hazard class of the Cargo. The classes are those as specified by the International Maritime Dangerous Goods code and the International Convention for the Safety of Life at Sea, 1974 Chapter VII, Part A.

The value of class is one of the following:

— class_1;

— class_21;

— class_22;

— class_23;

— class_3;

— class_41;

— class_42;

— class_43;

— class_51;

— class_52;

— class_61;

— class_62;

— class_71;

— class_72;

— class_73;

— class_8;

— class_9.

NOTE - See 4.2.71.1.1 - 4.2.71.1.17 for the definition of each allowable value for class.

4.2.71.1.1 class_1

class_1: A class_1 rating indicates that the Cargo is explosive.

4.2.71.1.2 class_21

class_21: A class_21 rating indicates that the Cargo is a flammable gas.

4.2.71.1.3 class_22

class_22: A class_22 rating indicates that the Cargo is a non-flammable gas

4.2.71.1.4 class_23

class_23: A class_23 rating indicates that the Cargo is a poisonous gas.

4.2.71.1.5 class_3

class_3: A class_3 rating indicates that the Cargo is a flammable liquid.

4.2.71.1.6 class_41

class_41: A class_41 rating indicates that the Cargo is a flammable solid.

4.2.71.1.7 class_42

class_42: A class_42 rating indicates that the Cargo is a substance likely to spontaneously combust.

4.2.71.1.8 class_43

class_43: A class_43 rating indicates that the Cargo will emit flammable gas when in contact with water.

4.2.71.1.9 class_51

class_51: A class_51 rating indicates that the Cargo is an oxidizing agent.

4.2.71.1.10 class_52

class_52: A class_52 rating indicates that the Cargo is an organic peroxide.

4.2.71.1.11 class_61

class_61: A class_61 rating indicates that the Cargo is toxic.

4.2.71.1.12 class_62

class_62: A class_ rating indicates that the Cargo is an infectious substance

4.2.71.1.13 class_71

class_71: A class_71 rating indicates that the Cargo is a Category I radioactive substance.

4.2.71.1.14 class_72

class_72: A class_72 rating indicates that the Cargo is a Catagory II radioactive substance.

4.2.71.1.15 class_73

class_73: A class_73 rating indicates that the Cargo is a Category III radioactive substance.

4.2.71.1.16 class_8

class_8: A class_8 rating indicates that the Cargo is corrosive.

4.2.71.1.17 class_9

class_9: A class_9 rating indicates that the Cargo is a miscellaneous, dangerous substance, that it is any other substance which experience has shown, or may show, to be of such a dangerous character that the provisions of Chapter VII, Part A of SOLAS 1974 shall apply.

4.2.71.2 subsidiary_risks

The subsidiary_risks specifies additional risks associated with the Cargo. The classes are those as specified by the International Maritime Dangerous Goods code and the International Convention for the Safety of Life at Sea, 1974 Chapter VII, Part A.

The value of subsidiary_risks is one of the following:

— class_1;

— class_21;

— class_22;

— class_23;

— class_3;

— class_41;

— class_42;

— class_43;

— class_51;

— class_52;

— class_61;

— class_62;

— class_71;

— class_72;

— class_73;

— class_8;

— class_9.

NOTE - See 4.2.71.2.1 - 4.2.71.2.17 for the definition of each allowable value for subsidiary_risks.

4.2.71.2.1 class_1

class_1: A class_1 rating indicates that the Cargo is explosive.

4.2.71.2.2 class_21

class_21: A class_21 rating indicates that the Cargo is a flammable gas.

4.2.71.2.3 class_22

class_22: A class_22 rating indicates that the Cargo is a non-flammable gas

4.2.71.2.4 class_23

class_23: A class_23 rating indicates that the Cargo is a poisonous gas.

4.2.71.2.5 class_3

class_3: A class_3 rating indicates that the Cargo is a flammable liquid.

4.2.71.2.6 class_41

class_41: A class_41 rating indicates that the Cargo is a flammable solid.

4.2.71.2.7 class_42

class_42: A class_42 rating indicates that the Cargo is a substance likely to spontaneously combust.

4.2.71.2.8 class_43

class_43: A class_43 rating indicates that the Cargo will emit flammable gas when in contact with water.

4.2.71.2.9 class_51

class_51: A class_51 rating indicates that the Cargo is an oxidizing agent.

4.2.71.2.10 class_52

class_52: A class_52 rating indicates that the Cargo is an organic peroxide.

4.2.71.2.11 class_61

class_61: A class_61 rating indicates that the Cargo is toxic.

4.2.71.2.12 class_62

class_62: A class_ rating indicates that the cargo is an infectious substance

4.2.71.2.13 class_71

class_71: A class_71 rating indicates that the cargo is a Category I radioactive substance.

4.2.71.2.14 class_72

class_72: A class_72 rating indicates that the cargo is a Catagory II radioactive substance.

4.2.71.2.15 class_73

class_73: A class_73 rating indicates that the cargo is a Category III radioactive substance.

4.2.71.2.16 class_8

class_8: A class_8 rating indicates that the Cargo is corrosive.

4.2.71.2.17 class_9

class_9: A class_9 rating indicates that the cargo is a miscellaneous, dangerous substance, that it is any other substance which experience has shown, or may show, to be of such a dangerous character that the provisions of Chapter VII, Part A of SOLAS 1974 shall apply to it.

4.2.72 Deadweight

A Deadweight is the weight of the passengers, crew, cargo, stores, ballast, fresh water, fuel oil, and other comsumables being carried by a Ship (see 4.2.122).

The data associated with a Deadweight are the following:

— deadweight_items;

— deadweight_value.

4.2.72.1 deadweight_items

The deadweight_items specifies the items on the Ship that constitute the Deadweight measurement.

4.2.72.2 deadweight_value

The deadweight_value specifies the value of the Deadweight.

4.2.73 Deck_cargo_assignment

A Deck_cargo_assignment is a type of Cargo_assignment (see 4.2.13) that is the allocation of Unit_cargo (see 4.2.149) to Spaces (see 4.2.125) on the deck of a Ship (see 4.2.122).

The data associated with a Deck_cargo_assignment are the following:

— cargo;

— position.

4.2.73.1 cargo

The cargo specifies the type of Unit_cargo that has been loaded on to the deck.

4.2.73.2 position

The position specifies the location on the deck where the Unit_cargo has been loaded.

4.2.74 Definable_object

A Definable_object is any type of business object that can be defined, i.e., that can be pointed to by Definition (see 4.2.75).

The data associated with a Definable_object are the following:

— definitions;

— id.

4.2.74.1 definitions

The definitions specifies the Definitions pointing to the Definable_object.

4.2.74.2 id

The id specifies the global unique identifier for the Definable_object.

4.2.75 Definition

A Definition is a type of Versionable_object (see 4.2.158) that is the basis for all types of Definable_object (see 4.2.74) definitions. Definitions support the following concepts in shipbuilding: design, function, manufacturing, general Ship (see 4.2.122) characteristics, design requirements, and parametric and library descriptions of objects.

The data associated with a Definition are the following:

— defined_for;

— id;

— local_units.

4.2.75.1 defined_for

The defined_for specifies the Definable_objects that are defined by the Definition.

4.2.75.2 id

The id specifies the global unique identifier for the Definition.

4.2.75.3 local_units

The local_units specifies the units that the Definition makes use of if they differ from the units globally defined for the Ship (see 4.2.122).

4.2.76 Design_definition

The Design_definition is a type of Definition (see 4.2.75) that is the basis for all types of design definitions. The ability to reference representations differentiates a Design_definition from a Definition.

The data associated with a Design_definition are the following:

— representations.

The representations specifies the Representations of the design definition. It is possible for a Design_definition to have multiple Representations.

EXAMPLE - a Design_definition may have multiple shape representations defined: wireframe, surface, and solid.

4.2.77 Design_requirement

A Design_requirement is a type of Definition (see 4.2.75) that represents a constraint placed on a design. These constraints identify the set of rules to which the design must adhere.

The data associated with a Design_requirement are the following:

— specification.

The specification specifies a set of Document_references that define a design requirement or rule.

4.2.78 Document

A Document is a type of Versionable_object (see 4.2.158) that references an unambigous identification of some human readable information defined outside ISO 10303. A document has an author and may be versioned.

The data associated with a Document are the following:

— has_author;

— has_title;

— source_type;

— summary.

4.2.78.1 has_author

The has_author specifies the person and/or organization that authored the Document.

4.2.78.2 has_title

The has_title specifies a description of the subject matter within the Document.

4.2.78.3 source_type

The source_type specifies the format of the document.

EXAMPLE - the Document may be in a printed copy of a book or in a file format.

4.2.78.4 summary

The summary is optional and if present, specifies a summary or abstract that describes the content of a document.

4.2.79 Document_reference

A Document_reference is the qualification of a Document or sections of a Document (see 4.2.78) in terms of its source or location.

EXAMPLE - if the Document_reference source is a book, the pointer could be a section label or a page number.

The data associated with a Document_reference are the following:

— assigned_document.

The assigned_document specifies the Document (or portion of a Document) that is to be associated with the product data.

4.2.80 Document_usage_constraint

A Document_usage_constraint is a constraint on the applicability of a Document (see 4.2.78). Applicability may be defined in terms of selecting a specific subset of a Document and/or interpreting the content of that specific Document section.

The data associated with a Document_usage_constraint are the following:

— element_name;

— line_number;

— page;

— paragraph;

— section;

— source.

4.2.80.1 element_name

The element_name specifies the name for this subset of the document.

4.2.80.2 line_number

The line_number is optional and if present, specifies a reference to a line number within the Document.

4.2.80.3 page

The page is optional and if present, specifies a reference to a page number. This may be represented as a single page number, a Roman number, or a combination of chapter and page number.

4.2.80.4 paragraph

The paragraph is optional and if present, specifies a reference to a paragraph identifier.

4.2.80.5 section

The section is optional and if present, specifies a reference to a section label.

4.2.80.6 source

The source specifies the Document that the associated specification of sections, pages, line_numbers, element_names, and paragraphs is related.

4.2.81 Dry_cargo

A Dry_cargo is a type of Cargo (see 4.2.12) that is not in liquid or gaseous form. Each Dry_cargo may be one of the following: a Bulk_cargo (see 4.2.8) or a Unit_cargo (see 4.2.149).

The data associated with a Dry_cargo are the following:

— permeability;

— stowage_factor.

4.2.81.1 permeability

The permeability specifies the amount by which the cargo takes up water.

4.2.81.2 stowage_factor

The stowage_factor specifies the amount of space that a weight of cargo occupies for the purpose of stowage in a Compartment (see 4.2.35). (Units are cubic metre per tonne).

4.2.82 Envisaged_version_creation

An Envisaged_version_creation is a type of Versionable_object_change_event (see 4.2.159) that is the Event (see 4.2.83) leading to a new Versionable_object (see 4.2.158). The event is an envisaged Event and has not yet happened. The Definition (see 4.2.75), Item_structure (see 4.2.98), or Item_relationship (see 4.2.97) as the subject of the Event does not yet exist and is described in terms of descriptive, non-formal properties.

The data associated with an Envisaged_version_creation are the following:

— base;

— category.

4.2.82.1 base

The base specifies the Versionable_objects the envisaged new version is derived from.

4.2.82.2 category

The category specifies the category the envisaged versionable object belongs to.

4.2.83 Event

An Event is identification that something has happened at a certain time, activated by a certain person for a certain reason. Each Event is either an Approval_event (see 4.2.3), a Check (see 4.2.25), or a Versionable_object_change_event (see 4.2.159).

The data associated with an Event are the following:

— caused_by;

— caused_when;

— description.

4.2.83.1 caused_by

The caused_by specifies the person and organization creating the Event.

4.2.83.2 caused_when

The caused_when specifies the date and time that the Event occurred.

4.2.83.3 description

The description specifies a description for the reason of the Event.

4.2.84 External_instance_reference

An External_instance_reference is an instance of an entity that does not exist in the same scope.

NOTE - the entity that is referenced must be a type of either Definable_object or Definition in order to be referable via a global unique identifier.

The data associated with an External_instance_reference are the following:

— entity_type;

— schema_name;

— target_GUID.

4.2.84.1 entity_type

The entity_type specifies the name of the type of the externally referenced instance.

4.2.84.2 schema_name

The schema_name specifies the schema in which the externally referenced instance is defined.

4.2.84.3 target_GUID

The target_GUID specifies the global unique identifier of the externally referenced instance

4.2.85 External_reference

An External_reference is the abstract notion of a data source external to the data set where an instance of this entity exists.

EXAMPLE - a Universal_ resource_locator denotes such a data source.

The data associated with an External_reference are the following:

— description;

— location.

4.2.85.1 description

The description specifies some additional information regarding the External_reference.

4.2.85.2 location

The location specifies the location of an external reference. In the case of a Universal_resource_locator, the location is computer accessible by a specified transmission protocol.

4.2.86 Fire_safe_coating

A Fire_safe_coating is a type of Coating (see 4.2.32) that is used on structure to retard the spread of fire.

The data associated with a Fire_safe_coating are the following:

— low_flame_spread;

— nitro_cellulose_based;

— primer.

4.2.86.1 low_flame_spread

The low_flame_spread specifies whether the coating has low flame spread characteristics, as specified by BS476 Part7 or other equivalent standards.

4.2.86.2 nitro_cellulose_based

The nitro_cellulose_based specifies whether the coating has a nitro-cellulose or other highly inflammable base.

4.2.86.3 primer

The primer specifies the Primer_coating (see 4.2.118) which is required by the Fire_safe_coating.

4.2.87 Floating_position

A Floating_position is the draught and attitude of the Ship (see 4.2.122) when immersed and the resulting displacement volume.

The data associated with a Floating_position are the following:

— angle_of_heel;

— angle_of_trim;

— breadth_of_waterline;

— draught_at_amidships;

— length_of_waterline;

— moulded_form_displacement.

4.2.87.1 angle_of_heel

The angle_of_heel specifies the angle of rotation around the X-axis of the Ship measured in radians and measured on a line parallel to the global Y-axis and the waterplane. The angle_of_heel is equal to zero when the centreplane is perpendicular to the waterplane. The angle_of_heel has positive values if the starboard side of the Ship moves down.

4.2.87.2 angle_of_trim

The angle_of_trim specifies the angle of rotation around the Y-axis of the Ship measured in radians and measured on a line parallel to the global X-axis and the waterplane. The angle_of_trim is equal to zero when the transverse cross-section is perpendicular to the waterplane. The angle_of_trim has positive values if the bow of the Ship moves up.

4.2.87.3 breadth_of_waterline

The breadth_of_waterline specifies the breadth of the current waterline.

4.2.87.4 draught_at_amidships

The draught_at_amidships specifies the distance from the operating waterplane to the moulded bottom of the Ship measured perpendicular at the centreline on the transverse cross-section amidships.

4.2.87.5 length_of_waterline

The length_of_waterline specifies the length of the current waterline.

4.2.87.6 moulded_form_displacement

The moulded_form_displacement specifies the wetted displacement of the Ship.

4.2.88 Frame_table

A Frame_table is a spacing table whose positions are a reference for the location of frames and are located on the global X-axis.

NOTE - Frames are used for the internal structure of the ship and they are structural elements. A ship can have more than 100 frames. The intersection curve between a frame and the hull moulded form is a curve of transversal section through the ship hull.

4.2.89 Functional_definition

The Functional_definition is a type of Definition (see 4.2.89) that specifies a role or purpose for a Definition.

The data associated with a Functional_definition are the following:

— local_units;

— user_def_function.

4.2.89.1 local_units

The local_units specifies that a Functional_definition shall not define local units.

4.2.89.2 user_def_function

The user_def_function is optional and if present, specifies a user-defined role or purpose of the Functional_definition.

4.2.90 Gaseous_cargo

A Gaseous_cargo is a type of Cargo (see 4.2.12) that is any Cargo whose natural condition is a non-solid, non-liquid gaseous state.

The data associated with a Gaseous_cargo are the following:

— cargo_type;

— required_carriage_pressure.

4.2.90.1 cargo_type

The cargo_type is optional and if present, specifies the type of gaseous Cargo that can be loaded into the Ship (see 4.2.122).

The value of cargo_type is one of the following:

— acetaldehyde;

— anhydrous_ammonia;

— avcat;

— butane;

— butadiene;

- butylene;
- diethyl_ether;
- dimethylamine;
- ethylene;
- ethyl_chlorine;
- ethylene_oxide;
- isoprene;
- isopropylamine;
- methane;
- methyl_chloride;
- monoethylamine;
- naptha;
- propane;
- propane_butane_mix;
- propylene_oxide;
- propylene;
- vinyl_ethyl_ether;
- vinyl_chloride_monomer.

NOTE - See 4.2.90.1.1 - 4.2.90.1.23 for the definition of each allowable value for cargo_type.

4.2.90.1.1 acetaldehyde

acetaldehyde: The cargo is acetaldehyde.

4.2.90.1.2 anhydrous_ammonia

anhydrous_ammonia: The cargo is anhydrous ammonia.

4.2.90.1.3 avcat

avcat: The cargo is avcat.

4.2.90.1.4 butane

butane: The cargo is butane.

4.2.90.1.5 butadiene

butadiene: The cargo is butadiene.

4.2.90.1.6 butylene

butylene: The cargo is butylene.

4.2.90.1.7 diethyl_ether

diethyl_ether: The cargo is diethyl ether.

4.2.90.1.8 dimethylamine

dimethylamine: The cargo is dimethylamine.

4.2.90.1.9 ethylene

ethylene: The cargo is ethylene.

4.2.90.1.10 ethyl_chlorine

ethyl_chlorine: The cargo is ethyl chlorine.

4.2.90.1.11 ethylene_oxide

ethylene_oxide: The cargo is ethylene oxide.

4.2.90.1.12 isoprene

isoprene: The cargo is isoprene.

4.2.90.1.13 isopropylamine

isopropylamine: The cargo is isopropylamine.

4.2.90.1.14 methane

methane: The cargo is methane.

4.2.90.1.15 methyl_chloride

methyl_chloride: The cargo is methyl chloride.

4.2.90.1.16 monoethylamine

monoethylamine: The cargo is monoethylamine.

4.2.90.1.17 naptha

naptha: The cargo is naptha.

4.2.90.1.18 propane

propane: The cargo is propane.

4.2.90.1.19 propane_butane_mix

propane_butane_mix: The cargo is a mix of propane and butane.

4.2.90.1.20 propylene_oxide

propylene_oxide: The cargo is propylene oxide.

4.2.90.1.21 propylene

propylene: The cargo is propylene.

4.2.90.1.22 vinyl_ethyl_ether

vinyl_ethyl_ether: The cargo is vinyl ethyl ether.

4.2.90.1.23 vinyl_chloride_monomer

vinyl_chloride_monomer: The cargo is vinyl chloride monomer.

4.2.90.2 required_carriage_pressure

The required_carriage_pressure specifies the required pressure of the Compartment (see 4.2.35) in which the Cargo is to be carried.

4.2.91 General_characteristics_definition

A General_characteristics_definition is a type of Definition (see 4.2.75) that provides a major part of the documentation of a Ship (see 4.2.122). It includes primary dimensions and capacities due to the contract of the product (Ship).

The data associated with a General_characteristics_definition are the following:

— defined_for.

The defined_for specifies a Ship or set of Ships for which the General_characteristics_definition applies.

4.2.92 General_compartment_property

A General_compartment_property is a type of Compartment_property (see 4.2.54) that defines generic properties that are applicable to all types of compartments. The types of properties that may be specified include information regarding the area, volume, volume permeability, coating, tightness, occupancy, air circulation rate, and illumination data for a Compartment (see 4.2.35).

4.2.93 Global_axis_placement

A Global_axis_placement is a type of General_characteristics_definition (see 4.2.91) that defines a fixed system of right handed orthogonal axes to which geometric data are referred. A Global_axis_placement shall have a positive Z-axis in an upward direction starting from the base of the Ship and a positive X-axis running along the Ship on the intersection of the centreline with the base. In one case it is directed from the after part of the Ship to the forward part of the Ship, in the other it is directed from the forward part of the Ship to the aft part of the Ship. The origin of the global axis placement can be any point on the X-axis. The distance of the after perpendicular from the origin and the orientation of the X-axis shall be specified. If any other system of axes is used, local or global, then the transformation relations between it and the Global_axis_placement shall be specified.

The data associated with a Global_axis_placement are the following:

— after_perpendicular_offset;

— orientation.

4.2.93.1 after_perpendicular_offset

The after_perpendicular_offset specifies the distance from the origin of the Global_axis_placement to the after perpendicular.

4.2.93.2 orientation

The orientation specifies the direction of the X-axis.

The value of orientation is one of the following:

— aft_pointing;

— forward_pointing.

NOTE - See 4.2.93.1 - 4.2.93.2.2 for the definition of each allowable value for orientation.

4.2.93.2.1 aft_pointing

aft_pointing: an orientation of a right handed Ship co-ordinate system that has the positive X-axis from the forward part of the ship directed to the aft part of the ship.

4.2.93.2.2 forward_pointing

forward_pointing: an orientation of a right handed Ship co-ordinate system that has the positive X-axis from the aft part of the ship directed to the forward part of the ship.

4.2.94 Global_id

A persistent, global identifier that uniqely identifies the definition.

The data associated with a Global_id are the following:

— id.

4.2.94.1 id

The id specifies a unique, persistent identifier consisting of a concatenation of a company identifier and a local id generated by the company.

4.2.95 Gross_tonnage

A Gross_tonnage is a type of Tonnage_measurement (see 4.2.146) that is the result of a calculation representing the total volume of a ship. It is the sum total of the overdeck and underdeck tonnages.

The data associated with a Gross_tonnage are the following:

— overdeck_tonnage;

— underdeck_tonnage.

4.2.95.1 overdeck_tonnage

The overdeck_tonnage specifies the volume to the inside of the frames and deck plating of the 'tween decks, poop, bridge, forecastle, deckhouses, and erections above the tonnage deck less the exempted Spaces (see 4.2.125). Spaces exempted include Dry_cargo (see 4.2.81) Space (unless in a break in the deck) and certain closed-in Spaces associated with machinery, safety equipment, navigation, galleys, washrooms, water ballast, and workshops.

4.2.95.2 underdeck_tonnage

The underdeck_tonnage specifies the total volume of the Ship below the tonnage deck to the inside of the frames, underside of the deck plating, and above the inner bottom.

4.2.96 Item

An Item is a type of Definable_object (see 4.2.74) that is a discrete, identifiable object used in one or more production activities. An Item is something (to be) created by a physical or mental activity or (automatically) derived from one or more other Items. An Item needs not to represent a physically realizable thing. It may also represent some abstract concept like activity, task, etc.

An Item provides the functionality to have relationships to other Items and to be a member in an Item_structure (see 4.2.98.1).

The data associated with an Item are the following:

— description;

— documentation;

— name;

— ship_context.

4.2.96.1 description

The description is optional and if present, specifies the description for an Item.

4.2.96.2 documentation

The documentation specifies documentation available for an Item.

4.2.96.3 name

The name specifies the human readable name of the concept that is represented by an Item.

4.2.96.4 ship_context

The ship_context is optional and if present, specifies the context of an Item in terms of its applicability to a Ship (see 4.2.122).

4.2.97 Item_relationship

An Item_relationship is a type of Definable_object (see 4.2.74) and Versionable_object (see 4.2.158) that defines the association of two Items (see 4.2.96). The related Items may share a common function or activity, or are dependent on each other.

The data associated with an Item_relationship are the following:

— contxt;

— external_item_1;

— external_item_2;

— item_1;

— item_2.

4.2.97.1 contxt

The contxt is optional and if present, specifies the significant features regarding the Items in their relationship in order to identify the impact of changes to an Item.

4.2.97.2 external_item_1

The external_item_1 is optional and if present, specifies the relating item of the relationship in the case where it is an externally referenced instance of an Item.

4.2.97.3 external_item_2

The external_item_2 is optional and if present, specifies the related item of the relationship in the case where it is an externally referenced instance of an Item.

4.2.97.4 item_1

The item_1 is optional and if present, specifies the relating item of the relationship in the case where it is in the same instance model as the Item.

NOTE - the items related by ITEM may be either local instances or external instances; WHERE rules ensure that either the local XOR the external instances exist

4.2.97.5 item_2

The item_2 is optional and if present, specifies the related item of the relationship in the case where it is in the same instance model as the Item.

4.2.98 Item_structure

An Item_structure is a type of Definable_object (see 4.2.74) and Versionable_object (see 4.2.158) that is a collection of Items (see 4.2.96) possibly related by Item_relationships (see 4.2.97). An Item_structure forms a graph without any restriction regarding the number of entries, the connectivity, nor the cyclicity.

The data associated with an Item_structure are the following:

— external_items;

— external_relationships;

— items;

— relationships.

4.2.98.1 external_items

The external_items specifies the Items belonging externally to an Item_structure.

4.2.98.2 external_relationships

The external_relationships specifies the relationships (external) between the Items belonging to an Item_structure.

4.2.98.3 items

The items specifies the Items belonging locally to an Item_structure.

4.2.98.4 relationships

The relationships specifies the relationships (local) between the Items belonging to an Item_structure.

4.2.99 Lane_position

A Lane_position is a type of Cargo_position (see 4.2.18) that identifies the position of a Unit_cargo (see 4.2.149) using a definition of the lanes on a deck. This will usually apply to Ships (see 4.2.122) used for vehicle stowage.

The data associated with a Lane_position are the following:

— deck_number;

— frame_number;

— lane_number;

— relating_to.

4.2.99.1 deck_number

The deck_number specifies the deck onto which the Cargo has been loaded.

4.2.99.2 frame_number

The frame_number specifies the longitudinal position of the Cargo on the deck.

4.2.99.3 lane_number

The lane_number specifies the transverse position of the Unit_cargo on the deck.

4.2.99.4 relating_to

The relating_to specifies the definition of the lanes to which the position refers.

4.2.100 Lightship_definition

A Lightship_definition is a type of Definition (see 4.2.75) that specifies the weight of the hull structure of the Ship (see 4.2.122), including the weight of any installed machinery and outfitting, but excluding the weight of the crew, any passengers, and cargoes.

The data associated with a Lightship_definition are the following:

— defined_for;

— lightship_centre_of_gravity;

— lightship_items;

— lightship_weight.

4.2.100.1 defined_for

The defined_for specifies that a Lightship_definition is only valid for types of Ships.

4.2.100.2 lightship_centre_of_gravity

The lightship_centre_of_gravity specifies the centre of gravity of the lightweight in the global co-ordinate system of the Ship (see 4.2.122).

4.2.100.3 lightship_items

The lightship_items specifies the components that make up the lightweight definition.

4.2.100.4 lightship_weight

The lightship_weight specifies the lightweight of the ship expressed in units of mass.

4.2.101 Lightship_weight_item

The Lightship_weight_item is a type of Weight_and_centre_of_gravity (see 4.2.163) that identifies the component that is a part of the total lightship weight. It may include the hull structure of the Ship, machinery, or outfitting, but does not include cargo, crew, or passengers.

The data associated with a Lightship_weight_item are the following:

— aft_weight_extent;

— fwd_weight_extent;

— lightship_item_description.

4.2.101.1 aft_weight_extent

The aft_weight_extent specifies the length ordinate in the local co-ordinate system of the Lightship_weight_item identifying the aft extent.

4.2.101.2 fwd_weight_extent

The fwd_weight_extent specifies the length ordinate in the local co-ordinate system of the Lightship_weight_item identifying the forward extent.

4.2.101.3 lightship_item_description

The lightship_item_description specifies a descriptive label of the Lightship_weight_item.

4.2.102 Liquid_cargo

A Liquid_cargo is a type of Cargo (see 4.2.12) that is any Cargo whose natural condition is a non-solid, non-gaseous liquid state.

The data associated with a Liquid_cargo are the following:

— cargo_type;

— required_carriage_pressure.

4.2.102.1 cargo_type

The cargo_type is optional and if present, specifies the type of Liquid_cargo that can be loaded into the Ship (see 4.2.122).

The value of cargo_type is one of the following:

— aviation_oil;

— cement;

— chemical;

— crude_oil;

— edible_oil;

— fuel_oil;

— fresh_water;

— liquified_petroleum_gas;

— lubricating_oil;

— product_oil;

— salt_water;

— sullage;

— vegetable_oil;

— water_ballast.

NOTE - See 4.2.102.1.1 - 4.2.102.1.14 for the definition of each allowable value for cargo_type.

4.2.102.1.1 aviation_oil

aviation_oil: The Cargo is aviation oil.

4.2.102.1.2 cement

cement: The Cargo is cement.

4.2.102.1.3 chemical

chemical: The Cargo is chemical.

4.2.102.1.4 crude_oil

crude_oil: The Cargo is crude oil.

4.2.102.1.5 edible_oil

edible_oil: The Cargo is edible oil.

4.2.102.1.6 fuel_oil

fuel_oil: The Cargo is fuel oil.

4.2.102.1.7 fresh_water

fresh_water: The Cargo is fresh water.

4.2.102.1.8 liquified_petroleum_gas

liquified_petroleum_gas: The Cargo is liquified petroleum gas.

4.2.102.1.9 lubricating_oil

lubricating_oil: The Cargo is lubricating oil.

4.2.102.1.10 product_oil

product_oil: The Cargo is product oil.

4.2.102.1.11 salt_water

salt_water: The Cargo is salt water.

4.2.102.1.12 sullage

sullage: The Cargo is sullage.

4.2.102.1.13 vegetable_oil

vegetable_oil: The Cargo is vegetable oil.

4.2.102.1.14 water_ballast

water_ballast: The Cargo is water for ballast.

4.2.102.2 required_carriage_pressure

The required_carriage_pressure specifies the required pressure of the Compartment (see 4.2.35) in which the Cargo is to be carried.

4.2.103 Liquid_cargo_assignment

A Liquid_cargo_assignment is a type of Compartment_cargo_assignment (see 4.2.41) that is a consignment of Liquid_cargo (see 4.2.102) or Gaseous_cargo (see 4.2.90) that has been allocated and loaded into a tank on the Ship.

4.2.104 Loading_condition_definition

A Loading_condition is a type of Definition (see 4.2.75) that is the description of the loading of the Ship (see 4.2.122). The loading includes Cargo (see 4.2.12) loads that have been allocated and loaded into Compartments (see 4.2.35) or on decks, the associated Deadweight (see 4.2.72.1), and Floating_position (see 4.2.87).

The data associated with a Loading_condition_definition are the following:

— cargo_loads;

— deadweight;

— description;

— floating_position.

4.2.104.1 cargo_loads

The cargo_loads specifies the description of the Cargo items that have been loaded onto the Ship.

4.2.104.2 deadweight

The deadweight specifies the definition of the Deadweight value and its deriviation.

4.2.104.3 description

The description is optional and if present, specifies the free text description of the loading condition.

4.2.104.4 floating_position

The floating_position specifies the attitude of the Ship in the water in its present loading condition.

4.2.105 Loading_condition_design_definition

A loading_condition_design_definition is a type of Loading_condition_definition (see 4.2.104) that is the description of the loading of the Ship (see 4.2.122). The loading includes Cargo (see 4.2.12) loads that have been allocated and loaded onto a Ship, the associated Deadweight (see 4.2.72), and Floating_position (see 4.2.87) necessary for analysis.

The data associated with a Loading_condition_design_definition are the following:

— type_of.

The type_of specifies the qualification on the loading conditions used during design.

The value of type_of is one of the following:

— maximum;

— minimum;

— actual;

— expected;

— other.

NOTE - See 4.2.105.1.1 - 4.2.105.1.5 for the definition of each allowable value for type_of.

4.2.105.1.1 maximum

maximum: the maximum design loading condition.

4.2.105.1.2 minimum

minimum: the minimum design loading condition.

4.2.105.1.3 actual

actual: the normal design loading condition.

4.2.105.1.4 expected

expected: the loading condition used to perform analyses.

4.2.105.1.5 other

other: a loading condition not covered by the other enumerated types.

4.2.106 Loading_condition_operating_definition

A loading_condition_operating_definition is a type of Loading_conditions_definition (see 4.2.106) that is the description of the loading of the Ship (see 4.2.122). The loading includes Cargo (see 4.2.12) loads that have been allocated and loaded onto a Ship, the associated Deadweight (see 4.2.72), and the place and date of loading.

The data associated with a Loading_condition_operating_definition are the following:

— date_of_loading;

— place_of_loading;

— type_of.

4.2.106.1 date_of_loading

The date_of_loading is optional and if present, specifies the date and time when the Ship was loaded to its present condition.

4.2.106.2 place_of_loading

The place_of_loading is optional and if present, specifies the port at which the Ship was last loaded.

4.2.106.3 type_of

The type_of specifies the qualification on the loading conditions used during operation of the Ship.

The value of type_of is one of the following:

— arrival;

— departure;

— actual;

— other.

NOTE - See 4.2.106.3.1 - 4.2.106.3.4 for the definition of each allowable value for type_of.

4.2.106.3.1 arrival

arrival: the loading condition when the Ship docked at port.

4.2.106.3.2 departure

departure: the loading condition when the Ship embarked from port.

4.2.106.3.3 actual

actual: the loading condition when the Ship is in normal service.

4.2.106.3.4 other

other: a loading condition not covered by the other enumerated types.

4.2.107 Local_co_ordinate_system

A Local_co_ordinate_system is used to locate something in space. A Local_co_ordinate_system is always defined with respect to another Co_ordinate_system, this might be the Global_axis_placement or another Local_co_ordinate_system.

NOTE - Local axes and origin are handled in the same way as for axis2_placement_3d. A local_co_ordinate system shall form always a right handed system.

The data associated with a Local_co_ordinate_system are the following:

— parent.

The parent specifies the underlaying coordinate system which serves as definition space for the current coordinate system.

4.2.108 Local_co_ordinate_system_with_position_reference

A Local_co_ordinate_system_with_position_reference is a special Local_co_ordinate system which directly refers to the unique Global_axis_placement as its parent. Its location is defined by references to longitudinal, vertical or transversal frames, possibly using an additional offset value (a distance). Alternatively absolute coordinates may be specified. Also, combinations of coordinates and references are valid. A Local_co_ordinate_system_with_position_reference shall not specify rotations as transformation to the global system, i.e. its axes are required to be parallel to the axes of the Global_axis_placement.

The data associated with a Local_co_ordinate_system_with_position_reference are the following:

— longitudinal_ref;

— transversal_ref;

— vertical_ref;

— location.

4.2.108.1 longitudinal_ref

The longitudinal_ref is optional and if present, specifies refers to a Longitudinal_position, possibly with an offset value or an absolute coordinate value along the longitudinal axis of the global co-ordinate system.

4.2.108.2 transversal_ref

The transversal_ref is optional and if present, specifies refers to a Transversal_position, possibly with an offset value or an absolute coordinate value along the transversal axis of the global co-ordinate system.

4.2.108.3 vertical_ref

The vertical_ref is optional and if present, specifies refers to a Vertical_position, possibly with an offset value or an absolute coordinate value along the vertical axis of the global co-ordinate system.

4.2.108.4 location

The location specifies origin of the local co_system, defined in the parent Co_ordinate_system. derived from local or possibly global definition.

4.2.109 Longitudinal_position

A Longitudinal_position is a type of Spacing_position (see 0) that is located on the global X-axis.

4.2.110 Longitudinal_table

A Longitudinal_table is a spacing table whose positions lie on the longitudinal axis of the global co-ordinate system which is the global x axis.

The data associated with a Longitudinal_table are the following:

— spacing_table_representations.

The spacing_table_representations specifies the longitudinal positions which make up the longitudinal table.

4.2.111 Moment_3d

A Moment_3d is a collection of moment components at three major co-ordinate system axes, vertical, transveral, and longitudinal.

The data associated with a Moment_3d are the following:

— longitudinal_moment;

— origin;

— transverse_moment;

— vertical_moment.

4.2.111.1 longitudinal_moment

The longitudinal_moment specifies the moment component along the longitudinal axis.

4.2.111.2 origin

The origin specifies the point in the local co-ordinate system about which the moment component is defined.

4.2.111.3 transverse_moment

The transverse_moment specifies the moment component along the transversal axis.

4.2.111.4 vertical_moment

The vertical_moment specifies the moment component along the vertical axis.

4.2.112 Moments_of_inertia

A Moments_of_inertia is the values of the area moments of the boundary formed by the intersection of the Compartment (see 4.2.35) and a plane representing the Cargo (see 4.2.12) and non-Cargo interface.

The data associated with a Moments_of_inertia are the following:

— long_moment_of_inertia;

— trans_moment_of_inertia.

4.2.112.1 long_moment_of_inertia

The long_moment_of_inertia specifies the value of the second moment of the boundary formed by the intersection of the Compartment and a plane representing the Cargo interface (i.e., liquid cargo static waterline). The lever of the moment is parallel to the longitudinal axis of the Ship (see 4.2.122).

4.2.112.2 trans_moment_of_inertia

The trans_moment_of_inertia specifies the trans_moment_of_inertia represents the value of 2.0 nd moment of the boundary formed by the intersection of the Compartment and a plane representing the Cargo interface (i.e., liquid cargo static waterline). The lever of the moment is parallel to the transverse axis of the Ship (see 4.2.122).

4.2.113 Net_tonnage

A Net_tonnage is a type of Tonnage_measurement (see 4.2.146) that is a calculation of the Cargo (see 4.2.12) carrying Space (see 4.2.125) within the Ship (see 4.2.122). It is the Gross_tonnage (see 4.2.95) with deductions for crew spaces, engine room, water ballast, and any Space not used for passengers or Cargo.

4.2.114 Non_manifold_surface_shape_representation

A Non_manifold_surface_shape_representation is a type of Shape_representation that defines the shape for Spaces (see 4.2.125). It is the only type of Shape_representation defined for this Part of ISO 10303 and is specified by 10303-508.

4.2.115 Owner_designation

An Owner_designation is a type of General_characteristics_definition (see 4.2.91) that specifies the organizations that order, own, and manage the Ship (see 4.2.122).

The data associated with an Owner_designation are the following:

— local_units;

— managing_company;

— ordering_company;

— owning_company.

4.2.115.1 local_units

The local_units specifies that an Owner_designation shall not define local units

4.2.115.2 managing_company

The managing_company specifies the Organization that is responsible for managing and operating the Ship

4.2.115.3 ordering_company

The ordering_company specifies the Organization that ordered the Ship at a shipyard.

4.2.115.4 owning_company

The owning_company specifies the Organization that legally owns the Ship.

4.2.116 Part

A Part is a type of Item (see 4.2.96) that is the atomic element within a product structure representing a System, an Assembly, or a Space. It is an Item created by a physical activity and made of a material.

4.2.117 Person_group

A Person_group is either of type passenger or a member of the crew. The data associated with Person_group consists of the type of person, the number of people, the area, and overall weight and volume taken up by the group on the Ship (see 4.2.122).

The data associated with a Person_group are the following:

— footprints;

— number_of_people;

— person_type;

— volume;

— weight_and_centre_of_gravity.

4.2.117.1 footprints

The footprints specifies the area of space taken up by the group.

4.2.117.2 number_of_people

The number_of_people specifies the number of people in the group.

4.2.117.3 person_type

The person_type specifies the role of the people in the group.

The value of person_type is one of the following:

— passengers;

— crew;

— officers;

— enlisted.

NOTE - See 4.2.117.3.1 - 4.2.117.5 for the definition of each allowable value for person_type.

4.2.117.3.1 passengers

passengers: The role of the Person is as a passenger.

4.2.117.3.2 crew

crew: The role of the Person is as a member of the crew.

4.2.117.3.3 officers

officers: The role of the Person is as an officer.

4.2.117.3.4 enlisted

enlisted: The role of the Person is as enlisted personnel.

4.2.117.4 volume

The volume specifies the volume of space taken up by the group.

4.2.117.5 weight_and_centre_of_gravity

The weight_and_centre_of_gravity specifies the weight of all the people in the group.

4.2.118 Primer_coating

A Primer_coating is a type of Coating used to coat metal after surface preparation and prior to fabrication, such that it has no significant deleterious effect on subsequent welding work.

4.2.119 Regulation

A Regulation is a specification of the set of all international and national regulations as well as standards that apply to the Ship (see 4.2.122).

The data associated with a Regulation are the following:

— international_regulations;

— national_regulations;

— standards.

4.2.119.1 international_regulations

The international_regulations specifies all relevant international regulations that apply to the Ship.

4.2.119.2 national_regulations

The national_regulations specifies all relevant national regulations that apply to the Ship.

4.2.119.3 standards

The standards specifies all relevant standards that apply to the Ship.

4.2.120 Revision

A Revision is a type of Versionable_object (see 4.2.158) that serves as the link between the object of interest, and the Definitions (see 4.2.75) of its constituents, and the associated members. A revision is not created automatically, but has to be created explicitly each time it is needed.

EXAMPLE - the object of interest can be a hull cross section whose members are plate definitions, but only those plate definitions that belong to the same version.

The data associated with a Revision are the following:

— members;

— name;

— reason.

4.2.120.1 members

The members specifies the Versionable_objects wihin the Revision.

4.2.120.2 name

The name specifies a label that identifies a particular Revision.

4.2.120.3 reason

The reason specifies a description of what caused the creation of a new Revision

4.2.121 Revision_with_context

A Revision_with_context is a type of Revision (see 4.2.120) that serves as the link between the object of interest, the context, and the Definitions (see 4.2.75) of its constituents and the associated members.

The data associated with a Revision_with_context are the following:

— context_of_revision.

The context_of_revision specifies the link to a higher level object of interest. This may not be known explicitly.

4.2.122 Ship

A Ship is a type of Item (see 4.2.96) that is the primary product supported by the suite of Shipbuilding Application Protocols. All data defining the product shall be related to a Ship. Product model definition data related to the Ship object is supported for many stages of the life cycle of a Ship, including new project, early and detailed design, production engineering, manufacturing, and operations.

NOTE - the name of the Ship is specified as a Definition in Ship_designation, where it may be versioned.

The data associated with a Ship are the following:

— units.

4.2.122.1.1 units

The units specifies a reference to a set of pre-defined units for all types of measures that may appear in the Ship model.

4.2.123 Ship_designation

A Ship_designation is a type of General_characteristics_definition (see 4.2.91) that specifies the identification given to the Ship (see 4.2.122) so that it can be categorized by any shipping related organization.

The data associated with a Ship_designation are the following:

— call_sign;

— flag_state;

— local_units;

— port_of_registration;

— ship_identification;

— ship_name;

— ship_type_description.

4.2.123.1 call_sign

The call_sign specifies a unique lifecycle identifier assigned to the Ship by the flag_state for radio communication.

4.2.123.2 flag_state

The flag_state specifies the national authority with which the Ship is registered.

4.2.123.3 local_units

The local_units specifies that a Ship_designation shall not define local units.

4.2.123.4 port_of_registration

The port_of_registration specifies the national homeport of the Ship. The port_of_registration lies within the jurisdiction of the flag_state.

4.2.123.5 ship_identification

The ship_identification specifies a general identifier unique to the Ship assigned during the classification process.

4.2.123.6 ship_name

The ship_name specifies the name of the Ship assigned by the owner.

4.2.123.7 ship_type_description

The ship_type_description specifies more details about the function of the Ship and additional information about the Cargo (see 4.2.12) carried. If the ship_type is user_defined, then the ship_type_description delivers the information for the type of the Ship.

4.2.124 Shipyard_designation

A Shipyard_designation is a type of General_characteristics_definition (see 4.2.91) that specifies the identification given to the Ship (see 4.2.122) by the shipbuilder.

The data associated with a Shipyard_designation are the following:

— local_units;

— role;

— shipyard;

— shipyard_new_building_id;

— shipyard_project_name.

4.2.124.1 local_units

The local_units specifies that a Shipyard_designation shall not define local units.

4.2.124.2 role

The role specifies the contractual obligation that the shipyard has in relation to the Ship.

The value of role is one of the following:

— prime_design;

— prime_build;

— prime_repair;

— prime;

— subcontractor.

NOTE - See 4.2.124.2.1 - 4.2.124.2.5 for the definition of each allowable value for role.

4.2.124.2.1 prime_design

prime_design: the prime contractor with contract responsibility for the design of the Ship

4.2.124.2.2 prime_build

prime_build: the prime contractor with contract responsibilities for manufacture of the Ship

4.2.124.2.3 prime_repair

prime_repair: the prime contractor with contract responsibilities for repair of the Ship.

4.2.124.2.4 prime

prime: the prime contractor for the Ship.

4.2.124.2.5 subcontractor

subcontractor: a subcontractor for the Ship.

4.2.124.3 shipyard

The shipyard specifies the name and organizational details of the facility building or repairing the Ship.

4.2.124.4 shipyard_new_building_id

The shipyard_new_building_id is optional and if present, specifies an identifier for the Ship that is assigned by the shipyard after an order has been confirmed.

4.2.124.5 shipyard_project_name

The shipyard_project_name specifies an identifier for the Ship that is assigned by the shipyard on receipt of an order, or tender, for a new ship.

4.2.125 Space

A Space is a type of Item (see 4.2.96) that defines the volume on board a Ship (see 4.2.122). A Space is either a Compartment (see 4.2.35) or a Zone (see 4.2.164). A Space may have Functional_definitions (see 4.2.89), Design_definitions (see 4.2.76), manufacturing definitions, and product structure definitions relating applicable properties to the Space.

4.2.126 Space_adjacency_relationship

A Space_adjacency_relationship is a type of Space_arrangement_relationship (see 4.2.127) that identifies Spaces (see 4.2.125) that share a common boundary. These Spaces may be arranged relative to one another and the relationship may exhibit certain properties or characteristics. Properties specified by this AP are accessibility, partial or complete adjacency, orientation, and shared surface areas. A collection of adjacency relationships define an arrangement and are valid only in the context of a specific Space.

The data associated with a Space_adjacency_relationship are the following:

— adjacency_access;

— adjacency_orientation;

— adjacency_type;

— adjacent_space_surface_area.

4.2.126.1 adjacency_access

The adjacency_access specifies that it is or is not intended that a means be provided to allow passage of a person between the two adjacent spaces. A value of YES specifies the design intent of accessibility.

4.2.126.2 adjacency_orientation

The adjacency_orientation specifies the positional context between two adjacent spaces.

The value of adjacency_orientation is one of the following:

— above;

— below;

— port;

— starboard;

— forward;

— aft.

NOTE - See 4.2.126.2.1 - 4.2.126.2.6 for the definition of each allowable value for adjacency_orientation.

4.2.126.2.1 above

above: a Space is above, or on top of, another Space.

4.2.126.2.2 below

below: a Space is below, or beneath, another Space.

4.2.126.2.3 port

port: a Space is to the port side of another Space.

4.2.126.2.4 starboard

starboard: a Space is to the starboard side of another Space.

4.2.126.2.5 forward

forward: a Space is forward, or in front of, another Space.

4.2.126.2.6 aft

aft: a Space is aft of, or behind, another Space.

4.2.126.3 adjacency_type

The adjacency_type specifies whether the two adjacent Spaces are completely or partially adjacent.

The value of adjacency_type is one of the following:

— partial;

— complete.

NOTE - See 4.2.126.3.1 - 4.2.126.3.2 for the definition of each allowable value for adjacency_type.

4.2.126.3.1 partial

partial: the boundaries are not identical.

4.2.126.3.2 complete

complete: the two Spaces have identical boundaries with respect to a specific orientation (e.g., both share a common forward longitudinal extent, or a common port transverse extent).

4.2.126.4 adjacent_space_surface_area

The adjacent_space_surface_area specifies the area of that portion of the boundary between adjacent Spaces that is common to both Spaces.

4.2.127 Space_arrangement_relationship

A Space_arrangement_relationship is a type of Item_relationship (see 4.2.97) that represents an association between two Spaces (see 4.2.125). A Space_arrangement_relationship is either a Space_adjacency_relationship (see 4.2.126), a Space_functional_relationship (see 0), a Space_connection_relationship (see 4.2.128), a Space_positional_relationship (see 4.2.131), or a Space_enclosing_relationship (see 4.2.129). The collection of the set of any particular category of relationships defines a network of inter-related Spaces.

The data associated with a Space_arrangement_relationship are the following:

— item_1;

— item_2;

— remark.

4.2.127.1 item_1

The item_1 specifies redeclaration of the first Items (see 4.2.96) attribute inherited from Item_relationship in order to constrain it to be a type of Space.

4.2.127.2 item_2

The item_2 specifies redeclaration of the second Item (see 4.2.96) attribute inherited from Item_relationship in order to constrain it to be of type Space.

4.2.127.3 remark

The remark specifies textual information used to further define the relationship between two related Spaces.

4.2.128 Space_connection_relationship

A Space_connection_relationship is a type of Space_arrangement_relationship (see 4.2.127) that identifies Spaces (see 4.2.125) that are intended to be interconnected in some way.

EXAMPLE - two tanks may be interconnected by a piping system to allow the transfer of ballast water between the tanks.

The data associated with a Space_connection_relationship are the following:

— connecting_system.

The connecting_system specifies the identification of the system that connects the two Spaces.

4.2.129 Space_enclosing_relationship

A Space_enclosing_relationship is a type of Space_arrangement_relationship (see 4.2.127) that identifies Spaces (see 4.2.125) that are completely contained within other Spaces. An enclosed Space is one that does not share a common boundary with another Space.

EXAMPLE - a lube oil storage tank mounted on a foundation within the main engine room.

4.2.130 Space_functional_relationship

A Space_functional_relationship is a type of Space_arrangement_relationship (see 4.2.127) that identifies Spaces (see 4.2.125) that are associated with other Spaces because of some common functionality.

EXAMPLE - port and starboard pairs of anti-roll tanks, or an ammunition storage space, cargo weapons elevator, and gun turret are related by function.

4.2.131 Space_positional_relationship

A Space_positional_relationship is a type of Space_arrangement_relationship (see 4.2.127) that identifies Spaces (see 4.2.125) whose position is dependent upon another Space. A variety of positional relationship types are supported that serve to define the significant aspects of the relationship.

The data associated with a Space_positional_relationship are the following:

— relationship_type.

The relationship_type specifies an indicator as to the kind of space positional relationship expressed. The relationship is defined in terms of topological aspects of the two related spaces.

The value of relationship_type is one of the following:

— forward_longitudinal_extent;

— aft_longitudinal_extent;

— port_transverse_extent;

— starboard_transverse_extent;

— forward_starboard_corner;

— forward_port_corner;

— aft_starboard_corner;

— aft_port_corner;

— centered_transverse;

— centered_longitudinal;

— matched_transverse;

— matched_longitudinal;

— matched_transverse_and_longitudinal;

— relative.

NOTE - See 4.2.131.1.1 - 4.2.131.1.14 for the definition of each allowable value for relationship_type.

4.2.131.1.1 forward_longitudinal_extent

forward_longitudinal_extent: a Space is positioned longitudinally forward relative to another Space.

4.2.131.1.2 aft_longitudinal_extent

aft_longitudinal_extent: a Space is positioned longitudinally aft relative to another Space.

4.2.131.1.3 port_transverse_extent

port_transverse_extent: a Space is positioned transversely and to the port side relative to another Space.

4.2.131.1.4 starboard_transverse_extent

starboard_transverse_extent: a Space is positioned transversely and to the starboard side relative to another Space.

4.2.131.1.5 forward_starboard_corner

forward_starboard_corner: a Space is positioned forward and to the starboard side relative to another Space.

4.2.131.1.6 forward_port_corner

forward_port_corner: a Space is positioned forward and to the port side relative to another Space.

4.2.131.1.7 aft_starboard_corner

aft_starboard_corner: a Space is positioned aft and to the starboard side relative to another Space.

4.2.131.1.8 aft_port_corner

aft_port_corner: a Space is positioned aft and to the port side relative to another Space.

4.2.131.1.9 centered_transverse

centered_transverse: a Space is centred transversely relative to another Space.

4.2.131.1.10 centered_longitudinal

centered_longitudinal: a Space is centred longitudinally relative to another Space.

4.2.131.1.11 matched_transverse

matched_transverse: a Space transversely matches another Space.

4.2.131.1.12 matched_longitudinal

matched_longitudinal: a Space longitudinally matches another Space.

4.2.131.1.13 matched_transverse_and_longitudinal

matched_transverse_and_longitudinal: a Space transversely and longitudinally matches another Space.

4.2.131.1.14 relative

relative: the locations of the two spaces are fixed relative to one another.

4.2.132 Space_product_structure

A Space_product_structure is a type of Item_structure (see 4.2.98) that serves as a collection of Parts (see 4.2.116) that are contained within a Compartment (see 4.2.35) or Zone (see 4.2.164). A Space_product_structure may be independent of any discipline. It may be defined to consist of Parts of any one or more disciplines.

The data associated with a Space_product_structure are the following:

— contained_in;

— items.

4.2.132.1 contained_in

The contained_in specifies the Compartment or Zone that all items are contained within.

4.2.132.2 items

The items specifies the Items (see 4.2.96) that constitute the Space_product_structure.

NOTE - constraints on Item_structure imply that the External_items also are Parts.

4.2.133 Space_product_structure_revision

A Space_product_structure_revision is a type of Revision_with_context (see 4.2.121) that relates the versions of Items (see 4.2.96) in a Space_product_structure (see 4.2.132) to a particular version of the Space_product_structure.

NOTE - the versions of Items is related through a particular Design_definition for each Item in the Item_structure.items.

The data associated with a Space_product_structure_revision are the following:

— context_of_revision;

— members.

4.2.133.1 context_of_revision

The context_of_revision specifies a description detailing the reason for the Revision (see 4.2.120).

4.2.133.2 members

The members specifies the Design_definitions (see 4.2.76) that are related to the Space_product_structure_revision.

4.2.134 Spacing_position

A Spacing_position is a position on one of the global co-ordinate axes of the Ship (see 4.2.122) that is used as a reference point for any geometrical or structural item during the design and manufacture of the Ship. Each Spacing_position is either a Longitudinal_position (see 0), Transversal_position (see 4.2.147), or a Vertical_position (see 4.2.160), and/or a Spacing_position_with_offset (see 4.2.135).

EXAMPLE - typically spacing positions are specified by LFR 123, TFR 10, 100, 100, A. In addition the distance to the global origin is defined, for instance by 154.5 metres.

The data associated with a Spacing_position are the following:

— name;

— position;

— position_number.

4.2.134.1 name

The name is optional and if present, specifies a label that is used to name the reference point.

4.2.134.2 position

The position specifies the distance to the origin of the global co-ordinate system of the Ship. The axis on which the distance is measured depends on the type of Spacing_position.

4.2.134.3 position_number

The position_number specifies the numerical identification that is given to the Spacing_position.

4.2.135 Spacing_position_with_offset

A Spacing_position_with_offset is a type of Spacing_position (see 4.2.134) that is a position defined by an offset to an existing Spacing_position on one of the global co-ordinate axes of the Ship (see 4.2.122). It is used as a reference point for any geometrical or structural item during the design and manufacture of the Ship.

The data associated with a Spacing_position are the following:

— offset;

— relating_spacing_position.

4.2.135.1 offset

The offset specifies the distance to the relating Spacing_position. The axis on which the distance is measured depends on the type of the relating Spacing_position.

4.2.135.2 relating_spacing_position

The relating_spacing_position specifies the Spacing_position from where the offset is taken to identify the Spacing_position_with_offset.

4.2.136 Spacing_table

A Spacing_table is a collection of Spacing_positions that defines a list of reference points along one of the co-ordinate axes of the Ship. There are several specific types of the Spacing_table which can be chosen.

EXAMPLE 1 - A frame table is a type of Spacing_table where the frame positions would be longitudinal positions.

The data associated with a Spacing_table are the following:

— spacing_table_representations;

— description;

— name.

4.2.136.1 spacing_table_representations

The spacing_table_representations specifies the positions which make up the table on the co-ordinate axis that are of interest.

4.2.136.2 description

The description is optional and if present, specifies the textual account of the reason why the Spacing_table was created and any additional text that is required to describe the purpose of the Spacing_table.

4.2.136.3 name

The name is optional and if present, specifies the context specific identification for the Spacing_table.

4.2.137 Stability_definition

A Stability_definition is a type of Design_definition (see 4.2.76) that defines the stability properties for a given intact Ship (see 4.2.122). The results are defined in a tabular form for different loading conditions and represent the righting arms and the centre of buoyancy for different heel angles.

NOTE - damage stability will be defined in a special type of Stability_definition.

The data associated with a Stability_definition are the following:

— defined_for;

— representations.

4.2.137.1 defined_for

The defined_for specifies the Ship for which the Stability_definition is defined.

4.2.137.2 representations

The representations specifies the Stability_table (see 4.2.140) which the Stability_definition represents.

4.2.138 Stability_properties_for_one_floating_position

A Stability_properties_for_one_floating_position is a type of Representation_item (see **Error! Reference source not found.**) that specifies the collection of values that represent the data specific to stability calculations for a particular Floating_position (see 4.2.87) for a moulded form of a Ship (see 4.2.122).

The data associated with a Stability_properties_for_one_floating_position are the following:

— centre_of_gravity_above_keel;

— definition_of_starting_floating_position;

— related_stability_table;

— stability_properties_for_different_angles_of_heel.

4.2.138.1 centre_of_gravity_above_keel

The centre_of_gravity_above_keel specifies the location for the centre of gravity of the Ship. It will be presumed that the location for the centre of gravity of the Ship will not change for different heel angles. The X-co-ordinate is measured from the aft perpendicular, the Y-co-ordinate is measured from the centreline and the Z-co-ordinate is measured from the baseline.

4.2.138.2 definition_of_starting_floating_position

The definition_of_starting_floating_position specifies the Floating_position of the Ship for specific loading conditions, which is used as the starting point for the calculations of the Stability_property (see 4.2.139). The Floating_position covers the draught, trim, heel, and corresponding volume of displacement for the Ship.

4.2.138.3 related_stability_table

The related_stability_table specifies the Stability_tables with which the Stability_properties_for_one_floating_position is associated.

4.2.138.4 stability_properties_for_different_angles_of_heel

The stability_properties_for_different_angles_of_heel specifies all the stability properties that are valid for the particular definition_of_starting_floating_position.

4.2.139 Stability_property

A Stability_property is a definition of all the necessary properties for the stability calculations for a moulded form of a Ship (see 4.2.122) with specific loading conditions.

The data associated with a Stability_property are the following:

— angle_of_heel;

— centre_of_buoyancy;

— righting_arm.

4.2.139.1 angle_of_heel

The angle_of_heel specifies the angle of rotation of the Ship around the X-axis. The angle_of_heel has positive values if the starboard side of the Ship moves down.

4.2.139.2 centre_of_buoyancy

The centre_of_buoyancy specifies the location of the volumetric centre of the submerged moulded form volume. The X-co-ordinate is measured from the aft perpendicular, the Y-co-ordinate is measured from the centreline, and the Z-co-ordinate is measured from the baseline.

4.2.139.3 righting_arm

The righting_arm specifies the distance between a perpendicular line through the centre_of_gravity_above_keel and a perpendicular line through the centre_of_buoyancy. Both lines are taken orthogonal to the heeled waterline.

4.2.140 Stability_table

A Stability_table is a type of representation that defines the stability properties for a given intact or damaged Ship (see 4.2.122), depending on the Stability_definition (see 4.2.136). The results are defined in a tabular form and represent the righting arms and the centre of buoyancy for different heel angles for one starting Floating_position (see 4.2.87).

The data associated with a Stability_table are the following:

— items;

— mean_shell_thickness.

4.2.140.1 items

The items specifies the stability properties, which are the righting arms and the centre of buoyancy for different heel angles for one starting Floating_position.

4.2.140.2 mean_shell_thickness

The mean_shell_thickness specifies the real value for the average thickness of the shell plating, which may be used to define the related extreme form for the stability properties for the ship including the thickness.

4.2.141 Station_table

A Station_table is a type of transversal table whose positions are a reference for the location of stations and are located on the global X axis.

> NOTE - Stations are used in the design process of a ship and the station curves are curves of transversal sections through the ship hull. There are usually 20.0 stations, but the number can differ from shipyard to shipyard.

4.2.142 Tank_compartment_property

A Tank_compartment_property is a type of Compartment_property (see 4.2.54) that specifies properties for Compartments (see 4.2.35) designated for carrying fluid Cargo (see 4.2.12) such as oil or fuel.

The data associated with a Tank_compartment_property are the following:

— design_properties;

— design_stowage_density;

— geometric_parameters;

— liquid_capacity;

— moments_of_inertia.

4.2.142.1 design_properties

The design_properties is optional and if present, specifies the properties of the tank required for the design of piping systems supplying the tank.

4.2.142.2 design_stowage_density

The design_stowage_density specifies the measure of the quantity per unit volume of the liquid Cargo for which the tank compartment is designed.

4.2.142.3 geometric_parameters

The geometric_parameters is optional and if present, specifies geometric properties of the tank compartment used for analysis of fluid Cargo sloshing.

4.2.142.4 liquid_capacity

The liquid_capacity specifies a volumetric characteristic of a tank compartment.

4.2.142.5 moments_of_inertia

The moments_of_inertia specifies the inertial resistance to motion of a fluid Cargo in the tank.

4.2.143 Tank_geometric_parameters

A Tank_geometric_parameters is the geometric properties of the tank Compartment (see 4.2.35) used for analysis of fluid Cargo (see 4.2.12) sloshing.

The data associated with a Tank_geometric_parameters are the following:

— breadth_wash;

— length_wash.

4.2.143.1 breadth_wash

The breadth_wash is optional and if present, specifies the breadth between effective wash bulkheads at the height of the load point.

4.2.143.2 length_wash

The length_wash is optional and if present, specifies the length between effective wash bulkheads at the height of the load point.

4.2.144 Tank_piping_design_properties

A Tank_piping_design_properties is the collection of properties specific to piping that occurs within, or is attached to, a tank Compartment (see 4.2.35).

The data associated with a Tank_piping_design_properties are the following:

— airpipe_height;

— filling_height;

— relief_valve_pressure_setting;

— sounding_pipe_height.

4.2.144.1 airpipe_height

The airpipe_height is optional and if present, specifies the height from the base line to the top of the air pipe, if any.

4.2.144.2 filling_height

The filling_height is optional and if present, specifies the maximum height for filling of the tank Compartment.

4.2.144.3 relief_valve_pressure_setting

The relief_valve_pressure_setting is optional and if present, specifies the opening pressure of the relief valve.

4.2.144.4 sounding_pipe_height

The sounding_pipe_height is optional and if present, specifies the height of a sounding pipe.

4.2.145 Tonnage_definition

A Tonnage_definition is a type of Definition (see 4.2.75) that defines a method of volume calculation applied to Ships (see 4.2.122). It is used for determining charges for facilities such as berthing, docking, and passage through canals and locks.

The data associated with a Tonnage_definition are the following:

— certificate;

— compensated_gross_tonnage;

— gross_tonnage;

— net_tonnage;

— spaces_excluded;

— tonnage_regulation.

4.2.145.1 certificate

The certificate specifies the document that is issued to the Ship owner by the authority that carried out the tonnage calculations.

4.2.145.2 compensated_gross_tonnage

The compensated_gross_tonnage specifies the Gross_tonnage (see 4.2.95) value compensated for the type and complexity of the vessel.

4.2.145.3 gross_tonnage

The gross_tonnage specifies the value and derivation of the Gross_tonnage (see 4.2.95) calculation.

4.2.145.4 net_tonnage

The net_tonnage specifies the value and deriviation of the Net_tonnage (see 4.2.113) calculation.

4.2.145.5 spaces_excluded

The spaces_excluded specifies the Spaces (see 4.2.125) that were excluded from the tonnage calculations.

4.2.145.6 tonnage_regulation

The tonnage_regulation specifies the regulations that were used to produce the tonnage calculations.

The value of tonnage_regulation is one of the following:

— suez;

— panama;

— convention1969.

NOTE - See 4.2.145.6.1 - 4.2.145.6.3 for the definition of each allowable value for tonnage_regulation.

4.2.145.6.1 suez

suez: a tonnage_regulation valid for the Suez canal region.

4.2.145.6.2 panama

panama: a tonnage_regulation valid for the Panama canal region.

4.2.145.6.3 convention1969

convention1969: a tonnage_regulation based on the Convention of 1969.

4.2.146 Tonnage_measurement

A Tonnage_measurement is the calculation of tonnage and the Spaces (see 4.2.125) that were included to obtain that calculation. Each Tonnage_measurement may be one of the following: a Net_tonnage (see 4.2.113) or a Gross_tonnage (see 4.2.95).

The data associated with a Tonnage_measurement are the following:

— date_of_measurement;

— spaces_included;

— tonnage_value.

4.2.146.1 date_of_measurement

The date_of_measurement specifies the date and time that the tonnage calculations were performed.

4.2.146.2 spaces_included

The spaces_included specifies the Compartment_group (see 4.2.46) that were included in the tonnage calculations.

4.2.146.3 tonnage_value

The tonnage_value specifies the numerical value resulting from the tonnage calculation.

4.2.147 Transversal_position

A Transversal_position is a type of Spacing_position (see 4.2.134) that is located on the global Y-axis.

4.2.148 Transversal_table

A Transversal_table is a spacing table whose positions lie on the transverse axis of the global co-ordinate system which is the global Y-axis.

The data associated with a Transversal_table are the following:

— spacing_table_representations.

The spacing_table_representations specifies the transversal positions which make up the transversal table.

4.2.149 Unit_cargo

A Unit_cargo is a type of Dry_cargo (see 4.2.81) that is Cargo (see 4.2.12) that is packed or comprises discrete units that can be loaded and stored individually on the Ship (see 4.2.122).

The data associated with a Unit_cargo are the following:

— bounding_space;

— cargo_type;

— footprints;

— lashing_points;

— shape_description;

— stack_limit;

— volume;

— weight_and_centre_of_gravity.

4.2.149.1 bounding_space

The bounding_space specifies the description of the total space needed for stowage of the Unit_cargo. This may be identical to the shape_description but may also include the surrounding space required for inspection and maintenance.

4.2.149.2 cargo_type

The cargo_type is optional and if present, specifies the type of Unit_cargo that can be loaded into the Ship.

The value of cargo_type is one of the following:

— vehicle;

— boat;

— trailer;

— container;

— undefined;

— cable;

— livestock;

— aircraft;

— drums;

— pallet.

NOTE - See 4.2.149.2.1 - 4.2.149.2.10 for the definition of each allowable value for cargo_type.

4.2.149.2.1 vehicle

vehicle: the Unit_cargo is a vehicle.

4.2.149.2.2 boat

boat: The Unit_cargo is a boat.

4.2.149.2.3 trailer

trailer: The Unit_cargo is trailer.

4.2.149.2.4 container

container: The Unit_cargo is a container.

4.2.149.2.5 undefined

undefined: The Unit_cargo is unspecified.

4.2.149.2.6 cable

cable: The Unit_cargo is cable.

4.2.149.2.7 livestock

livestock: The Unit_cargo is livestock.

4.2.149.2.8 aircraft

aircraft: The Unit_cargo is an aircraft.

4.2.149.2.9 drums

drums: The Unit_cargo is contained in drums.

4.2.149.2.10 pallet

pallet: The Unit_cargo is palletized.

4.2.149.3 footprints

The footprints specifies the description of the areas of the Unit_cargo which are in contact with the Ship deck or hanging point.

4.2.149.4 lashing_points

The lashing_points specifies the points at which lashings are secured to the Unit_cargo. These points are specified in the local co-ordinate system of the Unit_cargo.

4.2.149.5 shape_description

The shape_description specifies the definition of the true shape of the Unit_cargo.

4.2.149.6 stack_limit

The stack_limit is optional and if present, specifies the maximum number of this type of Unit_cargo that can be stacked on top of each other.

4.2.149.7 volume

The volume specifies the unit of volume of the Unit_cargo.

4.2.149.8 weight_and_centre_of_gravity

The weight_and_centre_of_gravity specifies the definition of the Unit_cargo weight and centre of gravity with respect to that local co-ordinate system, whose origin is at the base of the centre of plane area of the Cargo.

4.2.150 Unit_cargo_assignment

A Unit_cargo_assignment is a type of Compartment_cargo_assignment (see 4.2.41) that is a consignment of Unit_cargo (see 4.2.149) that has been allocated and loaded into a Compartment (see 4.2.35).

The data associated with a Unit_cargo_assignment are the following:

— position;

— unit_cargo_identifier.

4.2.150.1 position

The position specifies the position of the Unit_cargo within the Compartment where it has been loaded.

4.2.150.2 unit_cargo_identifier

The Unit_cargo_identifier specifies the label used to identify each Unit_cargo instance.

4.2.151 Universal_resource_locator

A Universal_resource_locator is the address of an electronic data source (i.e., an Internet address). This is an alternative to the common mail address as provided by ISO 10303-41.

The data associated with a Universal_resource_locator are the following:

— location;

— machine_adress;

— other_protocol_type;

— port;

— protocol.

4.2.151.1 location

The location specifies the path on the target machine where the document is located.

4.2.151.2 machine_adress

The machine_adress specifies the name of the target machine that provides the service (i.e., the ftp server name or an Internet address).

4.2.151.3 other_protocol_type

The other_protocol_type is optional and if present, specifies a transmission protocol apart from the ones specified in protocol.

4.2.151.4 port

The port is optional and if present, specifies the port for the protocol.

4.2.151.5 protocol

The protocol specifies the type of the transmission protocol (i.e., ftp, http...). Because there is a permanent development on this field it is not possible to cover all available protocol types with the enumeration. Because of this a protocol type USER_DEFINED is included and the optional other_protocol_type attribute is used to hold the protocol type in this case. A constraint assures that in the case of a USER_DEFINED, the other_protocol_type attribute is used.

The value of protocol is one of the following:

— http;

— ftp;

— user_defined.

NOTE - See 4.2.151.5.1 - 4.2.151.5.3 for the definition of each allowable value for protocol.

4.2.151.5.1 http

http: hyper text transfer protocol.

4.2.151.5.2 ftp

ftp: file transfer protocol.

4.2.151.5.3 user_defined

user_defined: user defined transfer protocol

4.2.152 Vehicle_load_description

A Vehicle_load_description is a definition of all the properties that are required to estimate the impact of a vehicle on a structural system.

The data associated with a Vehicle_load_description are the following:

— load_handling;

— load_per_wheel;

— max_tyre_pressure;

— number_of_wheels;

— print_area;

— type_of_vehicle.

4.2.152.1 load_handling

The load_handling specifies an indication whether the vehicle is for load handling only or will stay onboard when at sea.

4.2.152.2 load_per_wheel

The load_per_wheel specifies the maximum permitted load per wheel.

4.2.152.3 max_tyre_pressure

The max_tyre_pressure is optional and if present, specifies the maximum tyre pressure; only required if print_area is not known.

4.2.152.4 number_of_wheels

The number_of_wheels specifies the minimum number of wheels per vehicle.

4.2.152.5 print_area

The print_area is optional and if present, specifies the minimum area of a wheel that touches the deck.

4.2.152.6 type_of_vehicle

The type_of_vehicle specifies the name of the type of vehicle.

4.2.153 Version_creation

A Version_creation is a type of Versionable_object_change_event (see 4.2.159) that identifies the Event (see 4.2.83) leading to a new Definition (see 4.2.75), Item_structure (see 4.2.98), or Item_relationship (see 4.2.97). The base attribute shall be populated if the subject Versionable_object (see 4.2.158) is based upon an existing Versionable_object. The base Versionable_object need not be the immediately preceding version of the subject Versionable_object. The base Versionable_object may refer to any previous version in the Version_history (see 4.2.155) of the same Item (see 4.2.96), or to any Versionable_object of another Item that contributes to the creation of the subject Versionable_object.

The data associated with a Version_creation are the following:

— base;

— subject.

4.2.153.1 base

The base specifies the Versionable_objects the subject is derived from.

4.2.153.2 subject

The subject specifies the Versionable_object created by the Change (see 4.2.19) Event.

4.2.154 Version_deletion

A Version_deletion is a type of Versionable_object_change_event (see 4.2.159) that identifies the Event (see 4.2.83) leading to the deletion of a Definition (see 4.2.75), an Item_structure (see 4.2.98), or an Item_relationship (see 4.2.97).

The data associated with a Version_deletion are the following:

— subject.

The subject specifies the Versionable_object (see 4.2.158) deleted or to be deleted by the Change (see 4.2.19) Event.

4.2.155 Version_history

A Version_history is an identification of Versionable_objects (see 4.2.158) and their Version_relationships (see 4.2.157) in terms of their role as predecessors and successors with respect to each other.

NOTE - The Version_history shall be a directed acyclic graph. Consequently the Version_history may contain Versionable_objects considered alternatives with respect to each other (i.e., a Versionable_object having more than one successor), and merged Versionable_objects (a Versionable_object having more than one predecessor).

The data associated with a Version_history are the following:

— current_version;

— relationships;

— versions.

4.2.155.1 current_version

The current_version specifies the Versionable_object that plays the role of the current version in this Version_history.

4.2.155.2 relationships

The relationships specifies the Version_relationships within the Version_history.

4.2.155.3 versions

The versions specifies the Versionable_objects within the Version_history.

4.2.156 Version_modification

A Versionable_object_change_event is a type of Versionable_object_change_event (see 4.2.159) that identifies the Event (see 4.2.83) leading to a change of a Versionable_object (see 4.2.158), i.e., the creation of a new version for an existing object. The base Versionable_object need not be the immediately preceding version of the subject Versionable_object, but may refer to any previous version in the Version_history (see 4.2.155) of the same Item (see 4.2.96).

The data associated with a Version_modification are the following:

— base;

— subject.

4.2.156.1 base

The base specifies the Versionable_objects from which the subject is derived.

4.2.156.2 subject

The subject specifies the Versionable_object modified or to be modified by the Change (see 4.2.19) Event.

4.2.157 Version_relationship

A Version_relationship defines the relationship of two Versionable_objects (see 4.2.158) of the same type in terms of a Version_history (see 4.2.155).

The data associated with a Version_relationship are the following:

— predecessor;

— reason;

— successor.

4.2.157.1 predecessor

The predecessor specifies the Version from which the successor is derived.

4.2.157.2 reason

The reason specifies the reason for a new version, created by a certain person at a certain time.

4.2.157.3 successor

The successor specifies the Version that the predecessor is the preceding version of.

4.2.158 Versionable_object

A Versionable_object is any object that may be versioned. Each Versionable_object is either a Definition (see 4.2.75), Item_relationship (see 4.2.97), or Item_structure (see 4.2.98).

The data associated with a Versionable_object are the following:

— version_id.

The version_id specifies the identification of the version.

4.2.159 Versionable_object_change_event

A Versionable_object_change_event is a type of Event (see 4.2.83) that is a generalization of the events effectively changing a Definition (see 4.2.75), Item_structure (see 4.2.98), or Item_relationship (see 4.2.97).

4.2.160 Vertical_position

A Vertical_position is a type of Spacing_position (see 4.2.134) that is located on the global Z-axis.

4.2.161 Vertical_table

A Vertical_table is a spacing table whose positions lie on the vertical axis of the global co-ordinate system which is the global Z-axis.

The data associated with a Vertical_table are the following:

— spacing_table_representations.

The spacing_table_representations specifies the vertical positions which make up the vertical table.

4.2.162 Waterline_table

A Waterline_table is a type of vertical table whose positions are a reference for the location of waterlines and are located on the global Z-axis.

4.2.163 Weight_and_centre_of_gravity

A Weight_and_centre_of_gravity specifies the mass and possibly the centre of gravity of a Ship (see 4.2.122) Part (see 4.2.116). The moment components will be derived if the moment origin exists.

The data associated with a Weight_and_centre_of_gravity are the following:

— centre_of_gravity;

— mass;

— moment.

4.2.163.1 centre_of_gravity

The centre_of_gravity specifies the centre of gravity of a Ship Part.

4.2.163.2 mass

The mass specifies the weight of a Ship Part.

4.2.163.3 moment

The moment specifies the moment based on centre_of_gravity and weight.

4.2.164 Zone

A Zone is a type of Space (see 4.2.125) that represents an abstract bounded volume identifying a region of a Ship (see 4.2.122) with unique requirements or characteristics that must be specially treated in the design and/or manufacturing process.

4.2.165 Zone_design_definition

A Zone_design_definition is a type of Design_definition (see 4.2.76) that is the abstract definition of a version of a Zone (see 4.2.164) from a design perspective.

The data associated with a Zone_design_definition are the following:

— boundaries;

— constituent_compartments;

— defined_for;

— properties;

— representations.

4.2.165.1 boundaries

The boundaries specifies External_instance_references (see 4.2.84) to the moulded forms or structural system Items (see 4.2.96) that bound the Zone.

4.2.165.2 constituent_compartments

The constituent_compartments specifies the Compartments (see 4.2.35) that are contained within the Zone.

4.2.165.3 defined_for

The defined_for specifies that a Zone_design_definition is only valid for a Zone.

4.2.165.4 properties

The properties specifies a collection of properties applicable to or derived from the design of a Zone.

4.2.165.5 representations

The representations specifies that a Zone_design_definition shall only have Non_manifold_surface_shape_representations (see 4.2.114).

4.2.166 Zone_functional_definition

A Zone_functional_definition is a type of Functional_definition (see 4.2.89) that defines the functional role of a Zone (see 4.2.164); the role may be a pre-defined one or it may be user-defined.

The data associated with a Zone_functional_definition are the following:

— defined_for;

— used_for.

4.2.166.1 defined_for

The defined_for specifies that a Zone_functional_definition is only valid for a Zone.

4.2.166.2 used_for

The used_for specifies the name of a function that a specific Zone may have in a Ship (see 4.2.122).

The value of used_for is one of the following:

— subsafe_zone;

— pressure_zone;

— fire_zone;

— design_zone;

— damage_control_zone;

— arrangement_zone;

— user_defined.

NOTE - See 4.2.166.2.1 - 4.2.166.2.7 for the definition of each allowable value for used_for.

4.2.166.2.1 subsafe_zone

subsafe_zone: the Zone is defined to be a subsafe zone.

4.2.166.2.2 pressure_zone

pressure_zone: the Zone is defined to be a pressure zone.

4.2.166.2.3 fire_zone

fire_zone: the Zone is defined to be a fire zone.

4.2.166.2.4 design_zone

design_zone: the Zone is defined to be a design zone.

4.2.166.2.5 damage_control_zone

damage_control_zone: the Zone is defined to be a damage control zone.

4.2.166.2.6 arrangement_zone

arrangement_zone: the Zone is defined to be an arrangement zone.

4.2.166.2.7 user_defined

user_defined: the Zone function is defined by the user_def_function attribute.

4.3 Application assertions

This subclause specifies the application assertions for the ship arrangements application protocol. Application assertions specify the relationships between application objects, the cardinality of the relationships, and the rules required for the integrity and validity of the application objects and UoFs. The application assertions and their definitions are given below.

4.3.1 Approval_event to Approval_history

Each Approval_event has approval_reference defined by exactly one Approval_history. An Approval_history defines the approval_reference for an Approval_event.

4.3.2 Approval_history to Definition

Each Approval_history has subject defined by exactly one Definition. A Definition defines the subject for an Approval_history.

4.3.3 Arrangement_description to Arrangement_item_description

Each Arrangement_description has item_descriptions defined by one up to many Arrangement_item_description. A set of Arrangement_item_description objects defines the item_descriptions for an Arrangement_description.

4.3.4 Arrangement_description to Ship

Each Arrangement_description has defined_for defined by one up to many Ship. A set of Ship objects defines the defined_for for an Arrangement_description.

4.3.5 Bay_cell_position to Cargo_bay_definition

Each Bay_cell_position has relating_to defined by exactly one Cargo_bay_definition. A Cargo_bay_definition defines the relating_to for a Bay_cell_position.

4.3.6 Cargo to Cargo_material_properties

Each Cargo has Material_properties defined by zero or one Cargo_material_properties. A Cargo_material_properties defines the Material_properties for a Cargo.

4.3.7 Cargo to Dangerous_goods_code

Each Cargo has cargo_hazard defined by zero or one Dangerous_goods_code. A Dangerous_goods_code defines the cargo_hazard for a Cargo.

4.3.8 Cargo to Document_reference

Each Cargo has references defined by zero up to many Document_reference. A set of Document_reference objects defines the references for a Cargo.

4.3.9 Cargo_bay_definition to Compartment

Each Cargo_bay_definition has defined_for defined by one up to many Compartment. A set of Compartment objects defines the defined_for for a Cargo_bay_definition.

4.3.10 Cargo_bay_definition to Longitudinal_position

Each Cargo_bay_definition has longitudinal_cargo_positions defined by zero up to many Longitudinal_position. A set of Longitudinal_position objects defines the longitudinal_cargo_positions for a Cargo_bay_definition.

4.3.11 Cargo_bay_definition to Transversal_position

Each Cargo_bay_definition has transverse_cargo_positions defined by zero up to many Transversal_position. A set of Transversal_position objects defines the transverse_cargo_positions for a Cargo_bay_definition.

4.3.12 Cargo_bay_definition to Vertical_position

Each Cargo_bay_definition has vertical_cargo_positions defined by zero up to many Vertical_position. A set of Vertical_position objects defines the vertical_cargo_positions for a Cargo_bay_definition.

4.3.13 Cargo_compartment_property to Capacity_properties

Each Cargo_compartment_property has bulk_cargo_capacity defined by zero or one Capacity_properties. A Capacity_properties defines the bulk_cargo_capacity for a Cargo_compartment_property.

4.3.14 Change_definition to Change

Each Change_definition has defined_for defined by one up to many Change. A set of Change objects defines the defined_for for a Change_definition.

4.3.15 Change_impact to Versionable_object_change_event

Each Change_impact has impact defined by one up to many Versionable_object_change_event. A set of Versionable_object_change_event objects defines the impact for a Change_impact.

4.3.16 Change_plan to Change_impact

Each Change_plan has planned_impact defined by exactly one Change_impact. A Change_impact defines the planned_impact for a Change_plan.

4.3.17 Change_plan to Change_request

Each Change_plan has chosen_solution_for defined by exactly one Change_request. A Change_request defines the chosen_solution_for for a Change_plan.

4.3.18 Change_plan to Check

Each Change_plan has checks defined by zero up to many Check. A set of Check objects defines the checks for a Change_plan.

4.3.19 Change_realization to Change_impact

Each Change_realization has impact defined by exactly one Change_impact. A Change_impact defines the impact for a Change_realization.

4.3.20 Change_realization to Change_plan

Each Change_realization has realization_of defined by exactly one Change_plan. A Change_plan defines the realization_of for a Change_realization.

4.3.21 Change_realization to Check

Each Change_realization has checks defined by zero up to many Check. A set of Check objects defines the checks for a Change_realization.

4.3.22 Change_request to Change_impact

Each Change_request has solution_alternatives defined by zero up to many Change_impact. A set of Change_impact objects defines the solution_alternatives for a Change_request.

4.3.23 Class_and_statutory_designation to Class_notation

Each Class_and_statutory_designation has the_class defined by exactly one Class_notation. A Class_notation defines the the_class for a Class_and_statutory_designation.

4.3.24 Class_and_statutory_designation to Regulation

Each Class_and_statutory_designation has the_statutory defined by exactly one Regulation. A Regulation defines the the_statutory for a Class_and_statutory_designation.

4.3.25 Class_compartment_requirement_definition to Compartment

Each Class_compartment_requirement_definition has defined_for defined by one up to many Compartment. A set of Compartment objects defines the defined_for for a Class_compartment_requirement_definition.

4.3.26 Class_deck_load_requirement_definition to Vehicle_load_description

Each Class_deck_load_requirement_definition has vehicle_load defined by zero or one Vehicle_load_description. A Vehicle_load_description defines the vehicle_load for a Class_deck_load_requirement_definition.

4.3.27 Coating to Coating_certification

Each Coating has certification defined by zero up to many Coating_certification. A set of Coating_certification objects defines the certification for a Coating.

4.3.28 Compartment_cargo_assignment to Compartment

Each Compartment_cargo_assignment has compartment defined by exactly one Compartment. A Compartment defines the compartment for a Compartment_cargo_assignment.

4.3.29 Compartment_coating to Corrosion_protection

Each Compartment_coating has corrosion_protection defined by exactly one Corrosion_protection. A Corrosion_protection defines the corrosion_protection for a Compartment_coating.

4.3.30 Compartment_design_definition to Compartment

Each Compartment_design_definition has defined_for defined by one up to many Compartment. A set of Compartment objects defines the defined_for for a Compartment_design_definition.

4.3.31 Compartment_design_definition to Compartment_property

Each Compartment_design_definition has properties defined by zero up to many Compartment_property. A set of Compartment_property objects defines the properties for a Compartment_design_definition.

4.3.32 Compartment_design_requirement to Space

Each Compartment_design_requirement has defined_for defined by one up to many Space. A set of Space objects defines the defined_for for a Compartment_design_requirement.

4.3.33 Compartment_functional_definition to Compartment

Each Compartment_functional_definition has defined_for defined by one up to many Compartment. A set of Compartment objects defines the defined_for for a Compartment_functional_definition.

4.3.34 Compartment_group to Compartment

Each Compartment_group has compartment defined by zero up to many Compartment. A set of Compartment objects defines the compartment for a Compartment_group.

4.3.35 Compensated_gross_tonnage to Gross_tonnage

Each Compensated_gross_tonnage has gross_tonnage_measurement defined by exactly one Gross_tonnage. A Gross_tonnage defines the gross_tonnage_measurement for a Compensated_gross_tonnage.

4.3.36 Corrosion_control_coating to Primer_coating

Each Corrosion_control_coating has primer defined by exactly one Primer_coating. A Primer_coating defines the primer for a Corrosion_control_coating.

4.3.37 Corrosion_protection to Coating

Each Corrosion_protection has coating_material defined by exactly one Coating. A Coating defines the coating_material for a Corrosion_protection.

4.3.38 Corrosion_protection to Coating_level

Each Corrosion_protection has coating_height defined by exactly one Coating_level. A Coating_level defines the coating_height for a Corrosion_protection.

4.3.39 Damage_case to Compartment_design_definition

Each Damage_case has damaged_compartments defined by one up to many Compartment_design_definition. A set of Compartment_design_definition objects defines the damaged_compartments for a Damage_case.

4.3.40 Damage_case to Damage_position

Each Damage_case has position_of_damage defined by exactly one Damage_position. A Damage_position defines the position_of_damage for a Damage_case.

4.3.41 Damage_case to Loading_condition_definition

Each Damage_case has original_loads defined by exactly one Loading_condition_definition. A Loading_condition_definition defines the original_loads for a Damage_case.

4.3.42 Damage_stability_definition to Damage_case

Each Damage_stability_definition has extent_of_damage defined by one up to many Damage_case. A set of Damage_case objects defines the extent_of_damage for a Damage_stability_definition.

4.3.43 Damage_stability_definition to Ship

Each Damage_stability_definition has defined_for defined by one up to many Ship. A set of Ship objects defines the defined_for for a Damage_stability_definition.

4.3.44 Damage_stability_definition to Stability_table

Each Damage_stability_definition has representations defined by one up to many Stability_table. A set of Stability_table objects defines the representations for a Damage_stability_definition.

4.3.45 Deadweight to Cargo_assignment

Each Deadweight has deadweight_items defined by one up to many Cargo_assignment. A set of Cargo_assignment objects defines the deadweight_items for a Deadweight.

4.3.46 Deck_cargo_assignment to Cargo_position

Each Deck_cargo_assignment has position defined by exactly one Cargo_position. A Cargo_position defines the position for a Deck_cargo_assignment.

4.3.47 Deck_cargo_assignment to Unit_cargo

Each Deck_cargo_assignment has cargo defined by exactly one Unit_cargo. An Unit_cargo defines the cargo for a Deck_cargo_assignment.

4.3.48 Definable_object to Definition

Each Definable_object has definitions defined by zero up to many Definition. A set of Definition objects defines the definitions for a Definable_object.

4.3.49 Definable_object to Global_id

Each Definable_object has id defined by exactly one Global_id. A Global_id defines the id for a Definable_object.

4.3.50 Definition to Definable_object

Each Definition has defined_for defined by one up to many Definable_object. A set of Definable_object objects defines the defined_for for a Definition.

4.3.51 Definition to Global_id

Each Definition has id defined by exactly one Global_id. A Global_id defines the id for a Definition.

4.3.52 Derived_Unit to Derived_Unit_Element

Each Derived_Unit has elements defined by one up to many Derived_Unit_Element. A set of Derived_Unit_Element objects defines the elements for a Derived_Unit.

4.3.53 Derived_Unit_Element to Named_Unit

Each Derived_Unit_Element has unit defined by exactly one Named_Unit. A Named_Unit defines the unit for a Derived_Unit_Element.

4.3.54 Design_requirement to Document_reference

Each Design_requirement has specification defined by zero up to many Document_reference. A set of Document_reference objects defines the specification for a Design_requirement.

4.3.55 Document to Document_usage_constraint

Each Document has document_subset defined by one up to many Document_usage_constraint. A set of Document_usage_constraint objects defines the document_subset for a Document.

4.3.56 Document_usage_constraint to Document

Each Document_usage_constraint has source defined by exactly one Document. A Document defines the source for a Document_usage_constraint.

4.3.57 Envisaged_version_creation to Versionable_object

Each Envisaged_version_creation has base defined by zero up to many Versionable_object. A set of Versionable_object objects defines the base for an Envisaged_version_creation.

4.3.58 External_instance_reference to Global_id

Each External_instance_reference has target_GUID defined by exactly one Global_id. A Global_id defines the target_GUID for an External_instance_reference.

4.3.59 Fire_safe_coating to Primer_coating

Each Fire_safe_coating has primer defined by exactly one Primer_coating. A Primer_coating defines the primer for a Fire_safe_coating.

4.3.60 General_characteristics_definition to Ship

Each General_characteristics_definition has defined_for defined by one up to many Ship. A set of Ship objects defines the defined_for for a General_characteristics_definition.

4.3.61 Item to External_reference

Each Item has documentation defined by zero up to many External_reference. A set of External_reference objects defines the documentation for an Item.

4.3.62 Item to Ship

Each Item has ship_context defined by zero or one Ship. A Ship defines the ship_context for an Item.

4.3.63 Item_relationship to External_instance_reference

Each Item_relationship has external_item_1 defined by zero or one External_instance_reference. An External_instance_reference defines the external_item_1 for an Item_relationship.

4.3.64 Item_relationship to External_instance_reference

Each Item_relationship has external_item_2 defined by zero or one External_instance_reference. An External_instance_reference defines the external_item_2 for an Item_relationship.

4.3.65 Item_relationship to Item

Each Item_relationship has item_1 defined by zero or one Item. An Item defines the item_1 for an Item_relationship.

4.3.66 Item_relationship to Item

Each Item_relationship has item_2 defined by zero or one Item. An Item defines the item_2 for an Item_relationship.

4.3.67 Item_structure to External_instance_reference

Each Item_structure has external_items defined by zero up to many External_instance_reference. A set of External_instance_reference objects defines the external_items for an Item_structure.

4.3.68 Item_structure to External_instance_reference

Each Item_structure has external_relationships defined by zero up to many External_instance_reference. A set of External_instance_reference objects defines the external_relationships for an Item_structure.

4.3.69 Item_structure to Item

Each Item_structure has items defined by zero up to many Item. A set of Item objects defines the items for an Item_structure.

4.3.70 Item_structure to Item_relationship

Each Item_structure has relationships defined by zero up to many Item_relationship. A set of Item_relationship objects defines the relationships for an Item_structure.

4.3.71 Lane_position to Cargo_bay_definition

Each Lane_position has relating_to defined by exactly one Cargo_bay_definition. A Cargo_bay_definition defines the relating_to for a Lane_position.

4.3.72 Lightship_definition to Lightship_weight_item

Each Lightship_definition has lightship_items defined by zero up to many Lightship_weight_item. A set of Lightship_weight_item objects defines the lightship_items for a Lightship_definition.

4.3.73 Lightship_definition to Ship

Each Lightship_definition has defined_for defined by one up to many Ship. A set of Ship objects defines the defined_for for a Lightship_definition.

4.3.74 Loading_condition_definition to Cargo_assignment

Each Loading_condition_definition has cargo_loads defined by one up to many Cargo_assignment. A set of Cargo_assignment objects defines the cargo_loads for a Loading_condition_definition.

4.3.75 Loading_condition_definition to Deadweight

Each Loading_condition_definition has deadweight defined by exactly one Deadweight. A Deadweight defines the deadweight for a Loading_condition_definition.

4.3.76 Loading_condition_definition to Floating_position

Each Loading_condition_definition has floating_position defined by exactly one Floating_position. A Floating_position defines the floating_position for a Loading_condition_definition.

4.3.77 Longitudinal_table to Longitudinal_position

Each Longitudinal_table has spacing_table_representations defined by zero up to many Longitudinal_position. A list of Longitudinal_position objects defines the spacing_table_representations for a Longitudinal_table.

4.3.78 Person_group to Cargo_footprint

Each Person_group has footprints defined by exactly one Cargo_footprint. A Cargo_footprint defines the footprints for a Person_group.

4.3.79 Person_group to Weight_and_centre_of_gravity

Each Person_group has weight_and_centre_of_gravity defined by exactly one Weight_and_centre_of_gravity. A Weight_and_centre_of_gravity defines the weight_and_centre_of_gravity for a Person_group.

4.3.80 Regulation to Document_reference

Each Regulation has international_regulations defined by zero up to many Document_reference. A set of Document_reference objects defines the international_regulations for a Regulation.

4.3.81 Regulation to Document_reference

Each Regulation has national_regulations defined by zero up to many Document_reference. A set of Document_reference objects defines the national_regulations for a Regulation.

4.3.82 Regulation to Document_reference

Each Regulation has standards defined by zero up to many Document_reference. A set of Document_reference objects defines the standards for a Regulation.

4.3.83 Revision to Versionable_object

Each Revision has members defined by one up to many Versionable_object. A set of Versionable_object objects defines the members for a Revision.

4.3.84 Revision_with_context to Definable_object

Each Revision_with_context has context_of_revision defined by exactly one Definable_object. A Definable_object defines the context_of_revision for a Revision_with_context.

4.3.85 Ship to Item

Each Ship has ship_items defined by zero up to many Item. A set of Item objects defines the ship_items for a Ship.

4.3.86 Space_adjacency_relationship to Adjacent_space_surface_area

Each Space_adjacency_relationship has adjacent_space_surface_area defined by exactly one Adjacent_space_surface_area. An Adjacent_space_surface_area defines the adjacent_space_surface_area for a Space_adjacency_relationship.

4.3.87 Space_arrangement_relationship to Space

Each Space_arrangement_relationship has item_1 defined by exactly one Space. A Space defines the item_1 for a Space_arrangement_relationship.

4.3.88 Space_arrangement_relationship to Space

Each Space_arrangement_relationship has item_2 defined by exactly one Space. A Space defines the item_2 for a Space_arrangement_relationship.

4.3.89 Space_product_structure to Part

Each Space_product_structure has items defined by one up to many Part. A set of Part objects defines the items for a Space_product_structure.

4.3.90 Space_product_structure to Space

Each Space_product_structure has contained_in defined by exactly one Space. A Space defines the contained_in for a Space_product_structure.

4.3.91 Space_product_structure_revision to Design_definition

Each Space_product_structure_revision has members defined by one up to many Design_definition. A set of Design_definition objects defines the members for a Space_product_structure_revision.

4.3.92 Space_product_structure_revision to Space_product_structure

Each Space_product_structure_revision has context_of_revision defined by exactly one Space_product_structure. A Space_product_structure defines the context_of_revision for a Space_product_structure_revision.

4.3.93 Spacing_position_with_offset to Spacing_position

Each Spacing_position_with_offset has relating_spacing_position defined by exactly one Spacing_position. A Spacing_position defines the relating_spacing_position for a Spacing_position_with_offset.

4.3.94 Spacing_table to Spacing_position

Each Spacing_table has spacing_table_representations defined by zero up to many Spacing_position. A list of Spacing_position objects defines the spacing_table_representations for a Spacing_table.

4.3.95 Stability_definition to Ship

Each Stability_definition has defined_for defined by one up to many Ship. A set of Ship objects defines the defined_for for a Stability_definition.

4.3.96 Stability_definition to Stability_table

Each Stability_definition has representations defined by one up to many Stability_table. A set of Stability_table objects defines the representations for a Stability_definition.

4.3.97 Stability_properties_for_one_floating_position to Floating_position

Each Stability_properties_for_one_floating_position has definition_of_starting_floating_position defined by exactly one Floating_position. A Floating_position defines the definition_of_starting_floating_position for a Stability_properties_for_one_floating_position.

4.3.98 Stability_properties_for_one_floating_position to Stability_property

Each Stability_properties_for_one_floating_position has stability_properties_for_different_angles_of_heel defined by one up to many Stability_property. A list of Stability_property objects defines the stability_properties_for_different_angles_of_heel for a Stability_properties_for_one_floating_position.

4.3.99 Stability_properties_for_one_floating_position to Stability_table

Each Stability_properties_for_one_floating_position has related_stability_table defined by one up to many Stability_table. A set of Stability_table objects defines the related_stability_table for a Stability_properties_for_one_floating_position.

4.3.100 Stability_table to Stability_properties_for_one_floating_position

Each Stability_table has items defined by one up to many Stability_properties_for_one_floating_position. A set of Stability_properties_for_one_floating_position objects defines the items for a Stability_table.

4.3.101 Tank_compartment_property to Capacity_properties

Each Tank_compartment_property has liquid_capacity defined by zero up to many Capacity_properties. A set of Capacity_properties objects defines the liquid_capacity for a Tank_compartment_property.

4.3.102 Tank_compartment_property to Moments_of_inertia

Each Tank_compartment_property has moments_of_inertia defined by exactly one Moments_of_inertia. A Moments_of_inertia defines the moments_of_inertia for a Tank_compartment_property.

4.3.103 Tank_compartment_property to Tank_geometric_parameters

Each Tank_compartment_property has geometric_parameters defined by zero or one Tank_geometric_parameters. A Tank_geometric_parameters defines the geometric_parameters for a Tank_compartment_property.

4.3.104 Tank_compartment_property to Tank_piping_design_properties

Each Tank_compartment_property has design_properties defined by zero or one Tank_piping_design_properties. A Tank_piping_design_properties defines the design_properties for a Tank_compartment_property.

4.3.105 Tonnage_definition to Compartment

Each Tonnage_definition has spaces_excluded defined by zero up to many Compartment. A set of Compartment objects defines the spaces_excluded for a Tonnage_definition.

4.3.106 Tonnage_definition to Compensated_gross_tonnage

Each Tonnage_definition has compensated_gross_tonnage defined by exactly one Compensated_gross_tonnage. A Compensated_gross_tonnage defines the compensated_gross_tonnage for a Tonnage_definition.

4.3.107 Tonnage_definition to Document

Each Tonnage_definition has certificate defined by exactly one Document. A Document defines the certificate for a Tonnage_definition.

4.3.108 Tonnage_definition to Gross_tonnage

Each Tonnage_definition has gross_tonnage defined by exactly one Gross_tonnage. A Gross_tonnage defines the gross_tonnage for a Tonnage_definition.

4.3.109 Tonnage_definition to Net_tonnage

Each Tonnage_definition has net_tonnage defined by exactly one Net_tonnage. A Net_tonnage defines the net_tonnage for a Tonnage_definition.

4.3.110 Tonnage_measurement to Compartment_group

Each Tonnage_measurement has spaces_included defined by zero up to many Compartment_group. A set of Compartment_group objects defines the spaces_included for a Tonnage_measurement.

4.3.111 Transversal_table to Transversal_position

Each Transversal_table has spacing_table_representations defined by zero up to many Transversal_position. A list of Transversal_position objects defines the spacing_table_representations for a Transversal_table.

4.3.112 Unit_cargo to Cargo_footprint

Each Unit_cargo has footprints defined by exactly one Cargo_footprint. A Cargo_footprint defines the footprints for an Unit_cargo.

4.3.113 Unit_cargo to Weight_and_centre_of_gravity

Each Unit_cargo has weight_and_centre_of_gravity defined by exactly one Weight_and_centre_of_gravity. A Weight_and_centre_of_gravity defines the weight_and_centre_of_gravity for an Unit_cargo.

4.3.114 Unit_cargo_assignment to Cargo_position

Each Unit_cargo_assignment has position defined by exactly one Cargo_position. A Cargo_position defines the position for an Unit_cargo_assignment.

4.3.115 Version_creation to Versionable_object

Each Version_creation has base defined by zero up to many Versionable_object. A set of Versionable_object objects defines the base for a Version_creation.

4.3.116 Version_creation to Versionable_object

Each Version_creation has subject defined by exactly one Versionable_object. A Versionable_object defines the subject for a Version_creation.

4.3.117 Version_deletion to Versionable_object

Each Version_deletion has subject defined by exactly one Versionable_object. A Versionable_object defines the subject for a Version_deletion.

4.3.118 Version_history to Version_relationship

Each Version_history has relationships defined by zero up to many Version_relationship. A set of Version_relationship objects defines the relationships for a Version_history.

4.3.119 Version_history to Versionable_object

Each Version_history has versions defined by one up to many Versionable_object. A set of Versionable_object objects defines the versions for a Version_history.

4.3.120 Version_history to Versionable_object

Each Version_history has current_version defined by exactly one Versionable_object. A Versionable_object defines the current_version for a Version_history.

4.3.121 Version_modification to Versionable_object

Each Version_modification has base defined by one up to many Versionable_object. A set of Versionable_object objects defines the base for a Version_modification.

4.3.122 Version_modification to Versionable_object

Each Version_modification has subject defined by exactly one Versionable_object. A Versionable_object defines the subject for a Version_modification.

4.3.123 Version_relationship to Versionable_object

Each Version_relationship has predecessor defined by exactly one Versionable_object. A Versionable_object defines the predecessor for a Version_relationship.

4.3.124 Version_relationship to Versionable_object

Each Version_relationship has successor defined by exactly one Versionable_object. A Versionable_object defines the successor for a Version_relationship.

4.3.125 Vertical_table to Vertical_position

Each Vertical_table has spacing_table_representations defined by zero up to many Vertical_position. A list of Vertical_position objects defines the spacing_table_representations for a Vertical_table.

4.3.126 Weight_and_centre_of_gravity to Moment_3d

Each Weight_and_centre_of_gravity has moment defined by exactly one Moment_3d. A Moment_3d defines the moment for a Weight_and_centre_of_gravity.

4.3.127 Zone_design_definition to Compartment_property

Each Zone_design_definition has properties defined by zero up to many Compartment_property. A set of Compartment_property objects defines the properties for a Zone_design_definition.

4.3.128 Zone_design_definition to Zone

Each Zone_design_definition has defined_for defined by one up to many Zone. A set of Zone objects defines the defined_for for a Zone_design_definition.

4.3.129 Zone_functional_definition to Zone

Each Zone_functional_definition has defined_for defined by one up to many Zone. A set of Zone objects defines the defined_for for a Zone_functional_definition.

5. Application Interpreted Model

5.1 ARM to AIM Mapping

This section to be developed in CD version of the AP.

5.2 AIM EXPRESS Short Form

This section to be developed in CD version of the AP.

6. Conformance Requirements

Conformance to this part of ISO 10303 includes satisfying the requirements stated in this part, the requirements of the implementation method(s) supported, and the relevent requirements of the normative references.

An implementation shall support at least one of the following implementation methods:

— ISO 10303-21;

— ISO 10303-22.

Requirements with respect to implementation methods-specific requirements are specified in annex C.

The Protocol Implementation Conformance Statement (PICS) proforma lists the options or the combinations of options that may be included in the implementation. The PICS proforma is provided in annex D.

This part of ISO 10303 provides for a number of options that may be supported by an implementation. These options have been grouped into the following conformance classes:

— Class 1 is a conformance class to exchange early design data regarding ship arrangements;

— Class 2 is a conformance class to exchange detail design data regarding ship arrangements;

— Class 3 is a conformance class to exchange operational data regarding ship arrangements;

— Class 4 is a conformance class to exchange analysis data regarding ship arrangements.

Support for a particular conformance class requires support of all the options specified in that class.

Comformance to a particular class requires that all AIM elements defined as part of that class be supported. Table 1 defines the classes to which each AIM element belongs.

NOTE - ISO 10303-315 defines the abstract test suite to be used in the assessment of conformance. ISO 10303-32 describes the conformance assessment process.

Unit of Functionality	Conformance class			
	Class 1	Class 2	Class 3	Class 4
arrangement_descriptions	X			
arrangement_relationships		X		
cargoes			X	X
class_compartment_requirements		X		
coatings		X	X	
compartment_design_definitions		X	X	X
compartment_properties		X	X	X
compartments		X	X	X
configuration_management		X		
damaged_stability				X
date_time_resources		X		
definitions		X		
external_references		X		
items		X		
lightship_weight				X
loading_conditions				X
location_concepts		X		
organisation_resources		X		
product_structures		X	X	
representations		X		
shapes		X		X
ship_general_characteristics		X	X	X
ship_measures		X		
tonnage				X

Table 1 - Conformance classes

Annex A
(normative)

AIM EXPRESS expanded listing

This annex will be developed for the CD version of this document

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Annex B
(normative)

AIM short names

This annex will be developed for the CD version of this document.

Annex C
(normative)

Implementation method specific requirements

The implementation method defines what types of exchange behaviour are required with respect to this part of ISO 10303. Conformance to this part of ISO 10303 shall be realized in an exchange structure. The file format shall be encoded according to the syntax and EXPRESS language mapping defined in ISO 10303-21 and in the AIM defined in annex A of this part of ISO 10303. The header of the exchange structure shall identify use of this part of ISO 10303 by the schema name ‘Ship_arrangements’.

Annex D
(normative)

Protocol Implementation Conformance Statement (PICS) proforma

This clause lists the optional elements of this part of ISO 10303. An implementation may choose to support any combination of these optional elements. However, certain combinations of options are likely to be implemented together. These combinations are called conformance classes and are described in the subclauses of this annex.

This annex is in the form of a questionnaire. This questionnaire is intended to be filled out by the implementor and may be used in preparation for conformance testing by a testing laboratory. The completed PICS proforma is referred to as a PICS. This annex will be developed for the CD version of this document.

Annex E
(normative)

Information object registration

This annex will be developed for the CD version of this document.

Annex F
(informative)

Application activity model

The application activity model (AAM) is provided to aid in understanding the scope and information requirements defined in this application protocol. The model is presented as a set of figures that contain the activity diagrams and a set of definitions of the activities and their data. The application activity model is given in Figures F.1 through F.15. Activities and data flows that are out of scope are marked with an asterisk.

The viewpoint of the application activity model is of an observer of the global ship development process. This activity model identifies the life cycle activities across all shipbuilding APs with extensions and emphasis appropriate to the Ship Arrangements. Activities relevant to the shipbuilding lifecycle that are not expanded in this activity model but are detailed in other shipbuilding application protocols.

F.1 Application activity model definitions

The following terms are used in the application activity model. Terms marked with an asterisk are outside the scope of this application protocol.

The definitions in this annex do not supersede the definitions given in the main body of the text.

F.1.1 approve general arrangements : This is the top level activity for the approval of the general arrangements. It is the entry activity for both the Design Approval Preview and checking against rules and regulations. NB The ship is not certified by this activity alone.

F.1.2 approved design : The approved design is the final design to be submitted as an offer.

F.1.3 arrangements : The arrangements of the ship are the ship's compartments and spaces. Any description of arrangements will include associated definitions of purpose for the compartment or space.

F.1.4 availability, reliability and maintainability information * : The information about the components that is required to install them in the ship and is required for planned maintenance.

F.1.5 basic hull parameters : Estimated principal dimensions based on historical data or preliminary design development.

F.1.6 calculate capacities : This activity includes the calculation of capacities of compartments and holds such as underdeck space, bunker space, tanks, machinery room and double bottom peak.

F.1.7 calculate capacities, holds, bunker space : Calculation of all separate capacities (see F.1.7). This could be done with the help of integral calculus or approximate formulae. For instance the hold capacity could be calculated from sectional areas and the integration over space's length.

F.1.8 calculate cost of ship * : This activity describes creation of negotiating documents based on technical product data and their estimated manufacturing cost. The results of this activity may contain sale price documents, financing support plan and documents describing funding and possible loans.

F.1.9 calculate lightship weight : This activity is necessary to summarise all relevant weight components. Together with the deadweight it is relevant for estimating the displacement.

F.1.10 calculate stability and trim : This activity deals with stability calculations (intact and damage stability), trim calculations, and calculations of centres of gravity in consideration of loading conditions.

F.1.11 calculate tonnage, freeboard : This activity deals with the calculation of tonnage and freeboard. As a result of the freeboard calculation a portion of ship volumes will be defined as reserve volumes.

F.1.12 calculate trim : This task involves the calculation of trim due to the weight of the ship and the weight and distribution of cargo.

F.1.13 calculate underdeck space : The calculation of all internal volumes.

F.1.14 cargo weights : The cargo weights used in defining loading conditions.

F.1.15 certificates * : The certificates issued by the Classification Society on completing the ship.

F.1.16 check arrangements for dangerous cargo : This activity checks for compliance with rule requirements with respect to arrangements for dangerous cargo (fire protection, detection, extinction, extinguisher).

F.1.17 check cofferdams and tank content : This activity checks the necessity for separating tanks from each other by cofferdams based on tank contents.

F.1.18 check design against rules and regulations : This is the top level activity for the approval of the primary design as part of the approval and certification process. The content of this activity is the same for all ships when it comes to conformance with Main Class Rules, but varies when it comes to additional class rules (type of vessel) and register notations. The activities performed are tailored to the rule requirements for general arrangement and global strength. This part of the approval is necessary before the yard can start ordering steel.

F.1.19 check internal doors and hatches for WT integrity : This activity checks for compliance with rule requirements with respect to doors and hatches and watertight

integrity.

F.1.20 check position bulkheads : The checking of watertight integrity arrangements and stability conditions (intact and damage stability) to meet the relevant regulations given by Load Line conventions and the SOLAS convention.

F.1.21 check stability (intact, damage) : This activity includes the calculation of intact stability and damage stability. For the damage stability it is necessary to prove the buoyancy in damage conditions with the help of flooding curves (floodable and permissible length). The study of stability with calculation of different load conditions and damage conditions is necessary (i.e. lightship displacement and operation displacement).

F.1.22 Classification Society : An organisation that enhances the safety of life and property at sea by providing rules, regulations and personnel for assessing and classifying ships during their lifecycle.

F.1.23 cog and lightship weight : Summarise all centres of gravity and all weight components relevant for lightship weight.

F.1.24 complete and approve design of machinery * : The selection, arrangement and approval of the power plant in terms of the main engine, associated propulsion system and its auxiliary machinery.

F.1.25 complete and approve design of outfitting and distribution systems * : The selection and approval of the necessary outfitting equipment. The selection is based mainly on former designs and in accordance with the requirements. It also contains the layout of the different types of distribution systems such as piping and HVAC.

F.1.26 complete and approve design of ship structure * : The completion and approval of the ship structural design.

F.1.27 complete and approve ship design : The production and approval of ship design product data, documents and the classification drawings using the preliminary design from the bid preparation, as well as the required rules and regulations. The result of this activity is the approved design and the production and delivery schedule.

F.1.28 consultants : Organisations that provide specific services to shipyards, ship owners and classification societies during the ship lifecycle.

F.1.29 contract : The contract is the output from the activity which involves placing the order for the ship. The contract is used as a constraint in subsequent activities such as final design and approval and production.

F.1.30 cost * : The calculated cost of the ship based on the cost of material and labour.

F.1.31 create preliminary design : All design activities relevant in a very preliminary stage of ship design in consideration of classification rules, national/international demands,

shipyard constraints and owner requirements. The aim of this task is to make a shipyard offer.

F.1.32 create preliminary general arrangements : The activity that produces the preliminary compartmentation plans from the preliminary hull form definition.

F.1.33 create preliminary hull form : The activity that is the first step of designing a ship. Using parent ships main dimensions and form parameters one or more preliminary hull forms will be generated.

F.1.34 create preliminary machinery design * : The activity that produces the preliminary designs for the ship machinery; including the prime mover, shaft system, fuel system, power systems and cargo handling equipment.

F.1.35 create preliminary outfitting design * : The activity that produces the preliminary design for the ship's outfitting, including distributed systems, such as piping and electrical systems.

F.1.36 create preliminary structure design * : The activity that produces the preliminary steel structure design, including the arrangement of the primary structural members.

F.1.37 Critical Design Areas : The areas requiring thorough investigation and conformity checking identified by the Design Approval Preview.

F.1.38 decide post-sales & maintenance support * : The activity that puts together the maintenance package for the ship. This is part of the tender document and includes the post sales support.

F.1.39 decommission and disassemble * : All activities relating to the last stage of the ship's lifecycle. It consists of the decommissioning and dismantling of the ship.

F.1.40 define compartments : This activity deals with a preliminary establishment of main parameters. Main particulars are length between perpendiculars, breadth, depth, draught, Deadweight, Displacement and block coefficient. Also form parameters will be established like prismatic coefficient, waterline coefficient, midship section coefficient and angle of entrance of waterline.

F.1.41 define loading conditions : This activity deals with the loading conditions and is necessary to ascertain the payload as a function of the available capacities.

F.1.42 design modifications : Comments and recommendations on the design (red-marking). This might be comments related to primary design or detail design solutions, safety arrangements, etc.

F.1.43 design schedule : Data that controls the time from the design phase to production.

F.1.44 distribution and outfitting design * : The design of the distribution systems (electrical and piping) and the outfitting.

F.1.45 estimate hydrodynamics and powering * : The activity that approximates hydrodynamic properties data calculations such as resistance, propulsion, seakeeping and manoeuvrability for the preliminary hull form.

F.1.46 estimate weight : This task is necessary for calculating the lightship weight and consists of the calculation of the hull steel weights, machinery weights and weights of outfitting and accommodation.

F.1.47 evaluate hull steel weights : This activity defines the estimated steel weight with the help of empirical values in a very preliminary stage of the design.

F.1.48 evaluate machinery weights : This activity defines all separate weights belonging to the machinery plant, including auxiliary equipment.

F.1.49 evaluate request & schedule bid * : This describes the activities of the shipyard when evaluating the inquiry of the ship owner for a new ship.

F.1.50 evaluate weights of outfitting and accommodation : This activity defines all separate weights belonging to the outfitting and accommodation.

F.1.51 feedback : The outputs from activities which then feed back and modify previous activities in the lifecycle on the current or subsequent ships.

F.1.52 final compartment design:

F.1.53 finalise and approve general arrangements : The activity that details the general arrangement after having created a draft layout. The ship's systems are described by a compartment and access drawing showing the location, the access, and the size of the different compartments.

F.1.54 finalise and approve hull form : The activity in which the hull form is finalised from the preliminary design. The result is a final and approved hull form design.

F.1.55 finalise and approve hydrodynamics and powering * : This includes all relevant hydrodynamic calculations such as resistance, propulsion, seakeeping and manoeuvrability.

F.1.56 finalise capacities calculations : The activity which produces the final volumes and centres results for the final calculation of stability and trim.

F.1.57 finalise compartment definition : The activity which gives the definition of the ship's compartments.

F.1.58 finalise general arrangements : The activity in which the general arrangements are finalised from the preliminary design.

F.1.59 finalise production planning * : This produces outputs relating to the final construction sequence, the material supply and the management of time and people.

F.1.60 finalise stability and trim calculation : This activity produces a finalised trim and stability parameter.

F.1.61 finalise weight estimation : Produces the final weights and centres of gravity for the calculation of the final stability and trim.

F.1.62 floodable curves : Used in the activities which define compartments to establish the main bulkhead positions.

F.1.63 freeboard : The freeboard is the distance from the waterline to the upper surface of the freeboard deck at side.

F.1.64 fuel consumption : A fuel consumption calculation is used to estimate the needs of capacities for fuel.

F.1.65 general arrangements : The space arrangement plan from the preliminary design stage.

F.1.66 historical data from previous designs : Data held by the shipyard or model basin on previous ship designs and used to estimate the hydrodynamics, powering requirements and sea-keeping.

F.1.67 hull form sections : The design of the hull moulded form at planar sections taken along the longitudinal axis of the ship.

F.1.68 hull moulded form : The definition of the shape of the hull of the ship, resulting from the addition of the aft-body, mid-body and fore-body definitions, which does not take into account the thickness of the material from which the hull is made.

F.1.69 hull steel weights : These outputs are the results of several calculation and design activities which result in an estimated weight of the steel structure making up the hull.

F.1.70 hydrodynamics & powering results * : The results of calculations and model basin tests. They contain resistance, propulsion, propeller performance, brake power, service speed, sea keeping and manoeuvrability data.

F.1.71 hydrostatics *: Hydrostatic properties are used in checking of ship's stability.

F.1.72 knowledge and experience : The previous experience and knowledge of companies involved throughout the ship lifecycle.

F.1.73 laws, rules and regulations : National laws, statutory regulations and classification society rules that are used to control the design, manufacture, operation,

maintenance and scrapping of the ship.

F.1.74 list of required certificates * : The result of placing an order, this is the list supplied by the owner for certificate requirements.

F.1.75 machinery design * : The design drawings and electronic models of the ship mechanical systems. An output from the final design process.

F.1.76 machinery weights : These outputs are the results of several calculation and design activities which result in an estimated weight for all machinery.

F.1.77 manufacturing restrictions : A constraint on the ship construction and design processes governed by available technology and shipyard facilities.

F.1.78 material list * : The list of raw materials needed to manufacture the ship. A result of the final design process.

F.1.79 material allocation/ordering : The data describing the necessary material supply for production.

F.1.80 modifications from machinery : Modifications to the hydrodynamics and powering due to feedback from the preliminary machinery design.

F.1.81 modifications to hull form : Modifications to the hull shape due to feedback from hydrodynamics and powering results and the final design process.

F.1.82 offer : The result of the preliminary design process. It will contain the shipyard's data for producing the requested ship.

F.1.83 offer guidelines : The offer guidelines include the data necessary to make an unconditional offer to the ship owner

F.1.84 operate and maintain a ship * : The activity that describes the running and maintenance of the ship during its service lifetime.

F.1.85 operational information : Accumulated information during the operation phase of the ship used for maintenance and in the final scrapping stage.

F.1.86 outfitting weights : These outputs are the result of several calculation and design activities which result in an estimated weight for all outfitting systems and furnishings.

F.1.87 owner : The organisation which requests, orders and takes delivery of the ship.

F.1.88 owner request, requirements : The requirements document that is submitted to the shipyard by the owner upon the invitation to tender.

F.1.89 payload : This output calculates the payload as a function of the available

capacities.

F.1.90 perform DAP (Design Approval Preview) : This is the top level activity for the approval preview of ship design. This activity is a feasibility study conducted by a Classification Society, in which the design is checked very roughly to detect critical areas for thorough investigation and conformity checking both as a design comment and to draw attention to specific areas during design approval. The content of this activity may vary with contract specifications and type of ship.

F.1.91 perform ship lifecycle : All of the lifecycle activities associated with a ship.

F.1.92 place order * : The owner places an order for a ship from the bids that have been submitted. From this a contract is awarded.

F.1.93 planned maintenance system : Data created during the final design process and used during the operation and maintenance of the ship.

F.1.94 position of collision BHD : The position of collision bulkhead for passenger ships is usually constrained by the SOLAS convention for passenger ships and other rule constraints for other types of vessels.

F.1.95 pre layout : The very initial layout of the ship which is produced during the bid evaluation stage and is the basis for the preliminary design.

F.1.96 preliminary design : The preliminary design is that which is completed in the phases leading up to the submission of the tender.

F.1.97 preliminary hull form : The definition of the hull form, as a result of the preliminary design process. Used in the offer documents and for preliminary compartment design, hydrodynamics and powering calculations.

F.1.98 preliminary machinery design * : The definition of the ship mechanical systems. Used early to estimate the noise, speed and vibration and to estimate the machinery weights.

F.1.99 preliminary machinery, structure and outfitting design : Feedback consisting of the preliminary designs for machinery, structure and outfitting and furnishing. This allows the creation of preliminary general arrangements.

F.1.100 preliminary outfitting design : The definition of the ship's outfitting and accommodation, resulting from the preliminary design process.

F.1.101 preliminary structure design : The definition of the preliminary ship structure during the preliminary design process.

F.1.102 prepare bid : This activity includes all activities of the yard regarding preparation and submission of the offer to the ship owner for the ship to be built.

F.1.103 present offer * : The activity concerned with presentation of the offer to build the ship to the prospective ship owner.

F.1.104 produce and inspect a ship : This activity includes high-level activities such as produce, monitor and inspect ship production. Inspect, means the controlling of all activities throughout the whole production life cycle of a ship.

F.1.105 product component information * : The technical data about the components that will be incorporated into the ship. These are taken into consideration when the preliminary designs are being made.

F.1.106 propeller design * : The design of the propeller or propulsor as a result of the hydrodynamics and powering calculations. The design controls some of the machinery design activity.

F.1.107 refined design : The final compartment definitions.

F.1.108 request a ship * : The first activities of a ship owner when intending to order a ship. Having definite ideas regarding appearance and functionality of the ship, the owner expresses these ideas in an inquiry to the shipyard.

F.1.109 request for production changes : Changes that are requested to the ship design as a result of production experience or difficulties with the realisation of the ship design.

F.1.110 resistance and shaft power : The result of the activity to estimate hydrodynamics and powering. Resistance and shaft power is a constraint on the creation of the preliminary hull form.

F.1.111 resources : The shipyard, classification society, and outside consultants.

F.1.112 resources allocation : A result of production planning.

F.1.113 schedule : The schedule is formed as a part of the final design process. It governs the timing of the production phases.

F.1.114 scrapping plan * : The document used to schedule the time and resources required to dismantle the ship.

F.1.115 ship product model data : The product data of the accumulated throughout its lifecycle. Because scrapping is part of the lifecycle the ship is not an output, only the documented information and knowledge about the ship survives.

F.1.116 ship weight modifications : Modifications to ship weight due to the preliminary structure design. This is fed back to modify the preliminary hull form and revise the preliminary general arrangements.

F.1.117 shipyard : An organisation that designs, builds, maintains, and repairs ships.

F.1.118 specify ship : All activities associated with the production of a detailed specification of the ship prior to a contract being placed.

F.1.119 stability parameter : Parameters including several results of stability calculations.

F.1.120 structural design * : The design of the hull structure including hull, bulkheads, decks and stiffeners.

F.1.121 technical requirements : The owner's specifications that must be realised by the completed ship.

F.1.122 technical documentation : In case of maintenance the technical documentation of a system means part of the product description required to perform preventative maintenance, repair and failure analysis of that system. Technical information is an output which includes more detail information about material parts needed for producing the ship/system.

F.1.123 transportation need : A constraint which determines the specification for the ship construction.

F.1.124 tonnage : Tonnage is a method of volume calculation applied to ships.

F.1.125 trim : The expected floating position of the ship resulting from calculation of the weights and their distribution throughout the ship.

F.1.126 volumes and centres : Volumes and centres of holds, bunkers, tanks and compartments.

F.1.127 weights and centres of gravity : Weights and centres of gravity necessary for further calculations.

F.1.128 weight distribution * : The details of the weight distribution taking into account steel weight, machinery weights, outfitting weights and cargo.

F.1.129 workload * : The total effort required to build the chosen ship design as estimated by the shipyard and assisting consultants.

F.2 Application activity model diagrams

The application activity model diagrams are given in Figures F.1 through F.15. The graphical form of the application activity model is presented in the IDEF0 [2] activity modelling format. Activities and data flows that are out of scope are marked with asterisks.

USED AT:	AUTHOR: John Kendall	DATE: 21/05/96	x	WORKING	READER DATE	CONTEXT:
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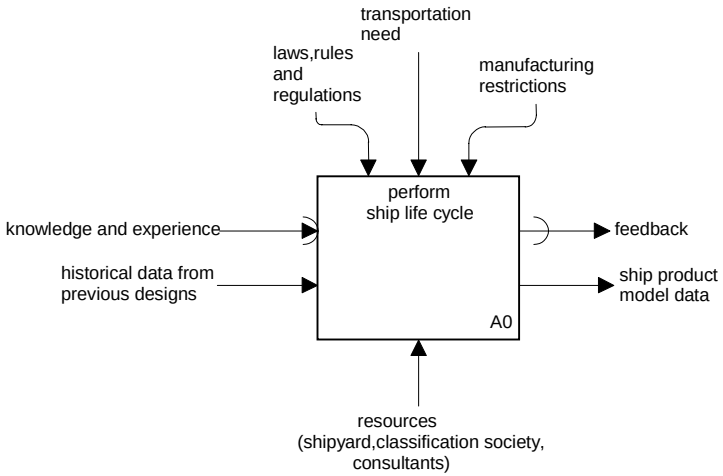

NODE: A-0	TITLE:	NUMBER: P. 1

Figure F.1 - Ship arrangements AAM

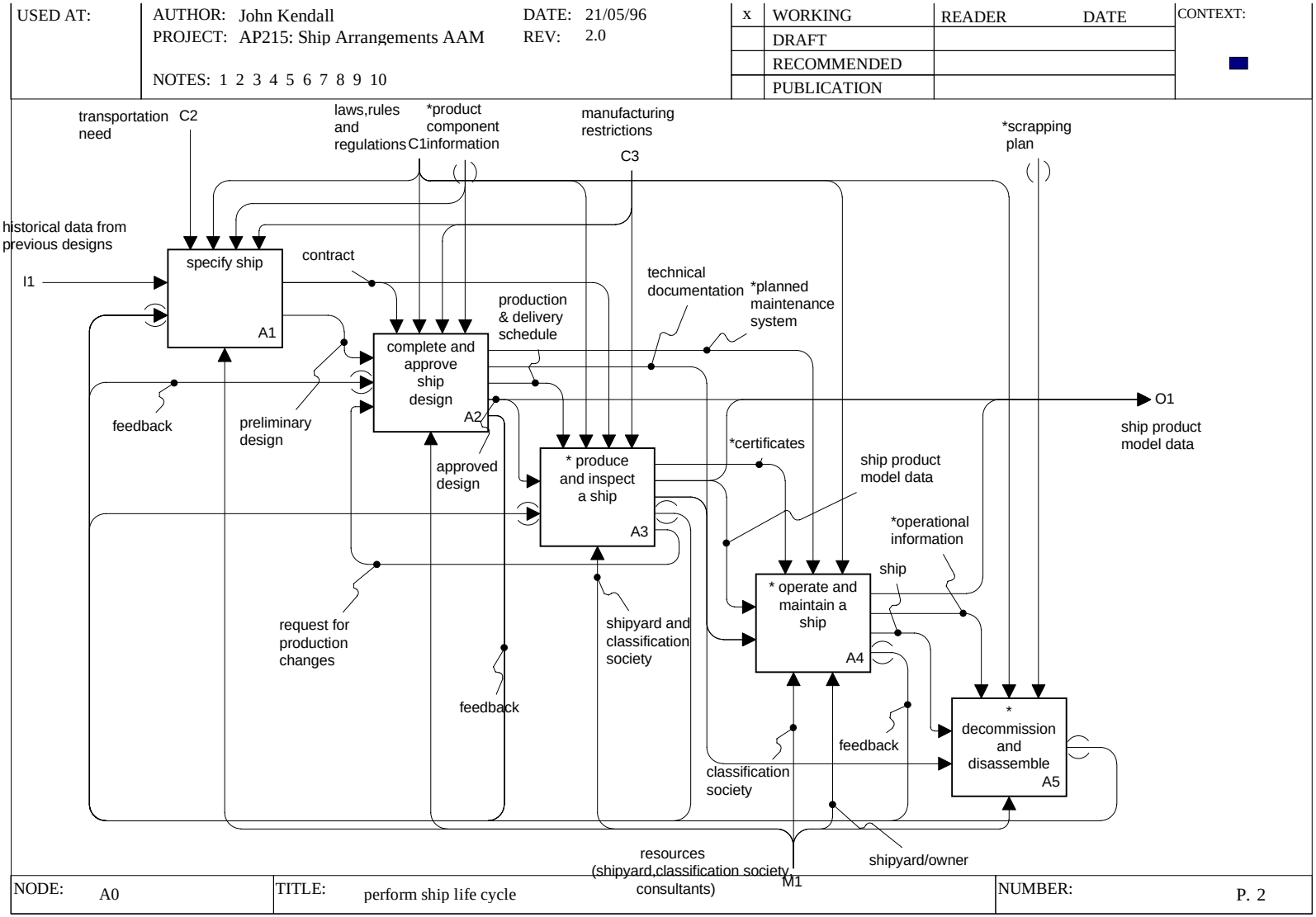

Figure F.2 - Perform ship life cycle

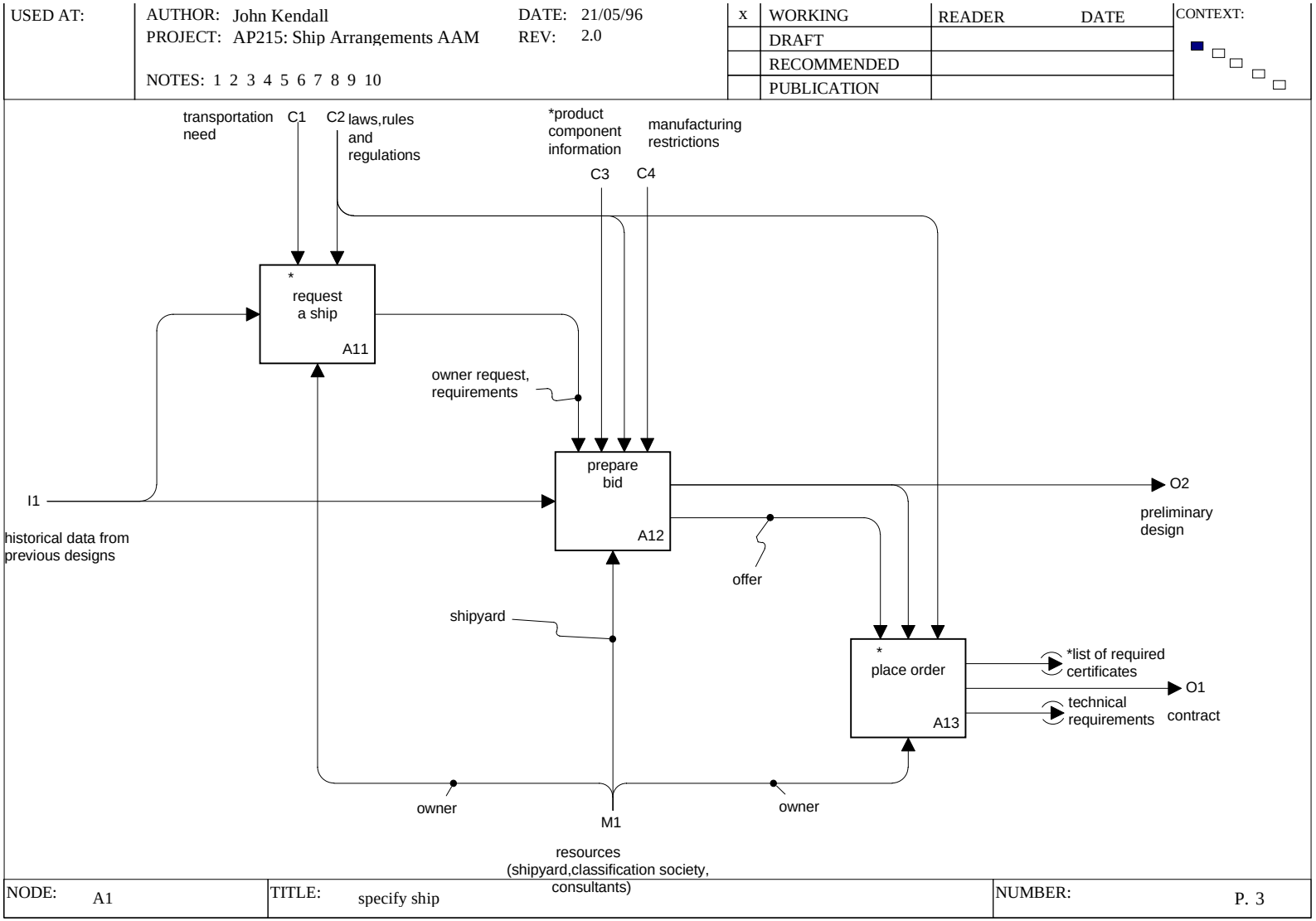

Figure F.3 - Specify ship

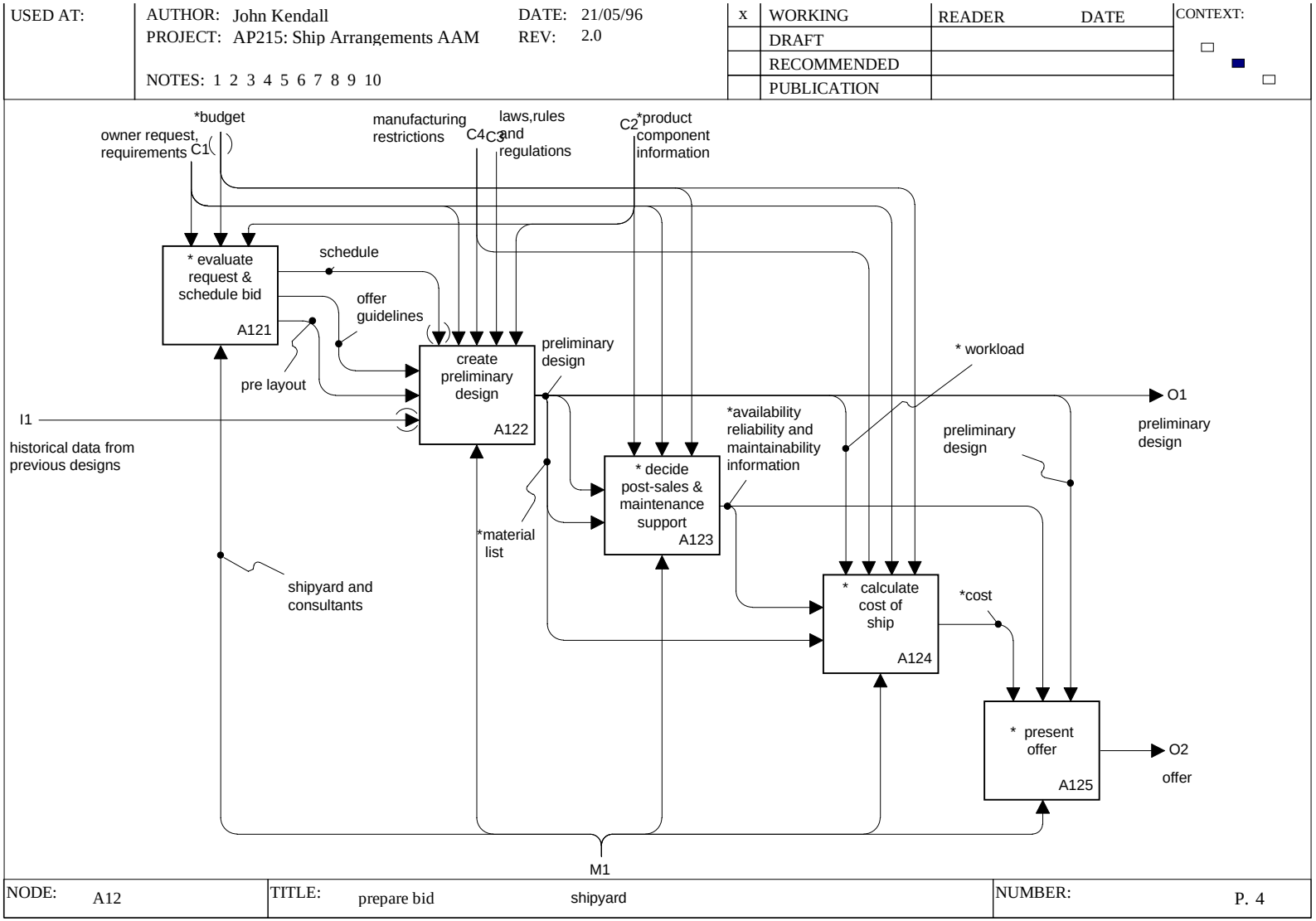

Figure F.4 - Prepare bid

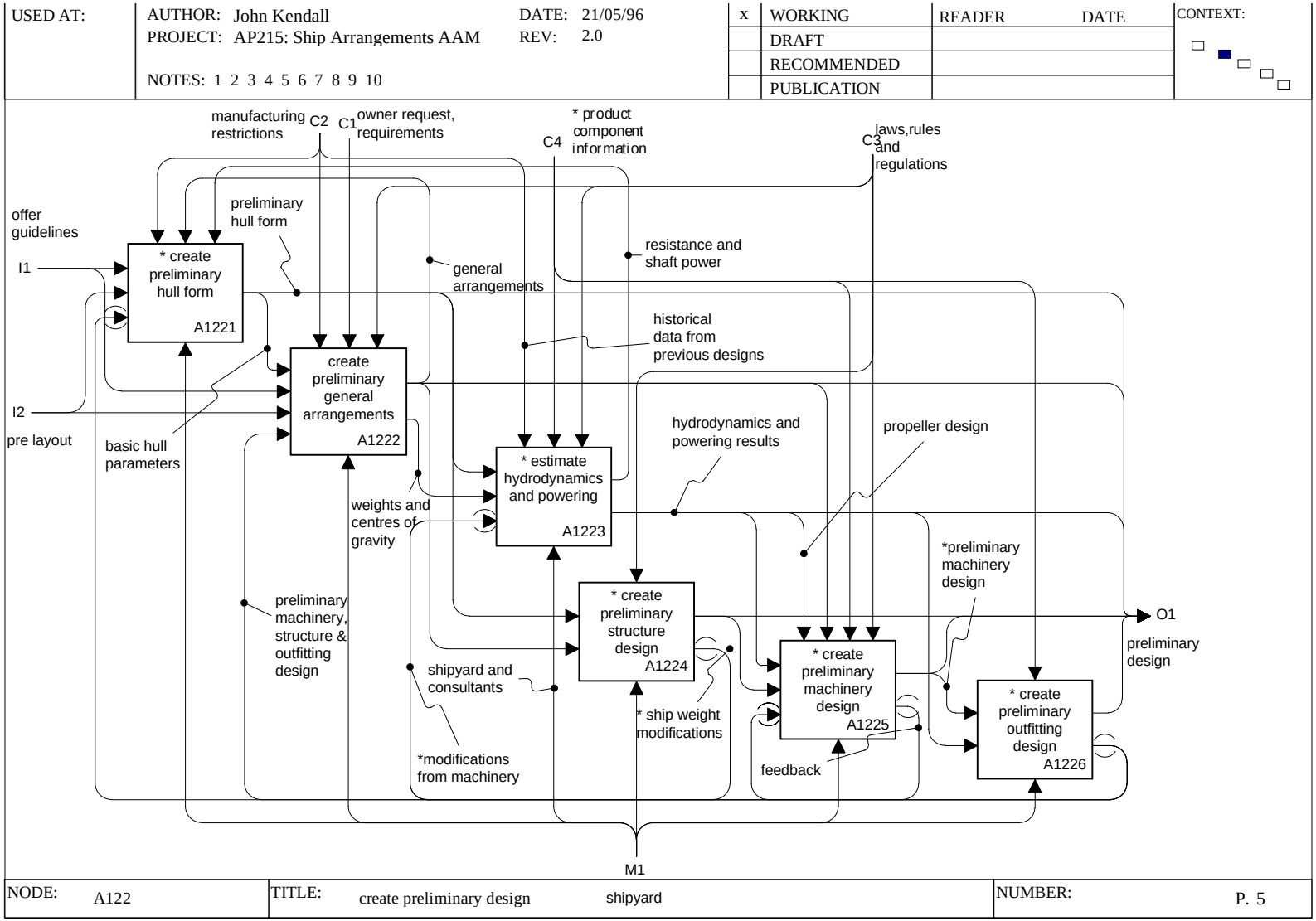

Figure F.5 - Create preliminary design

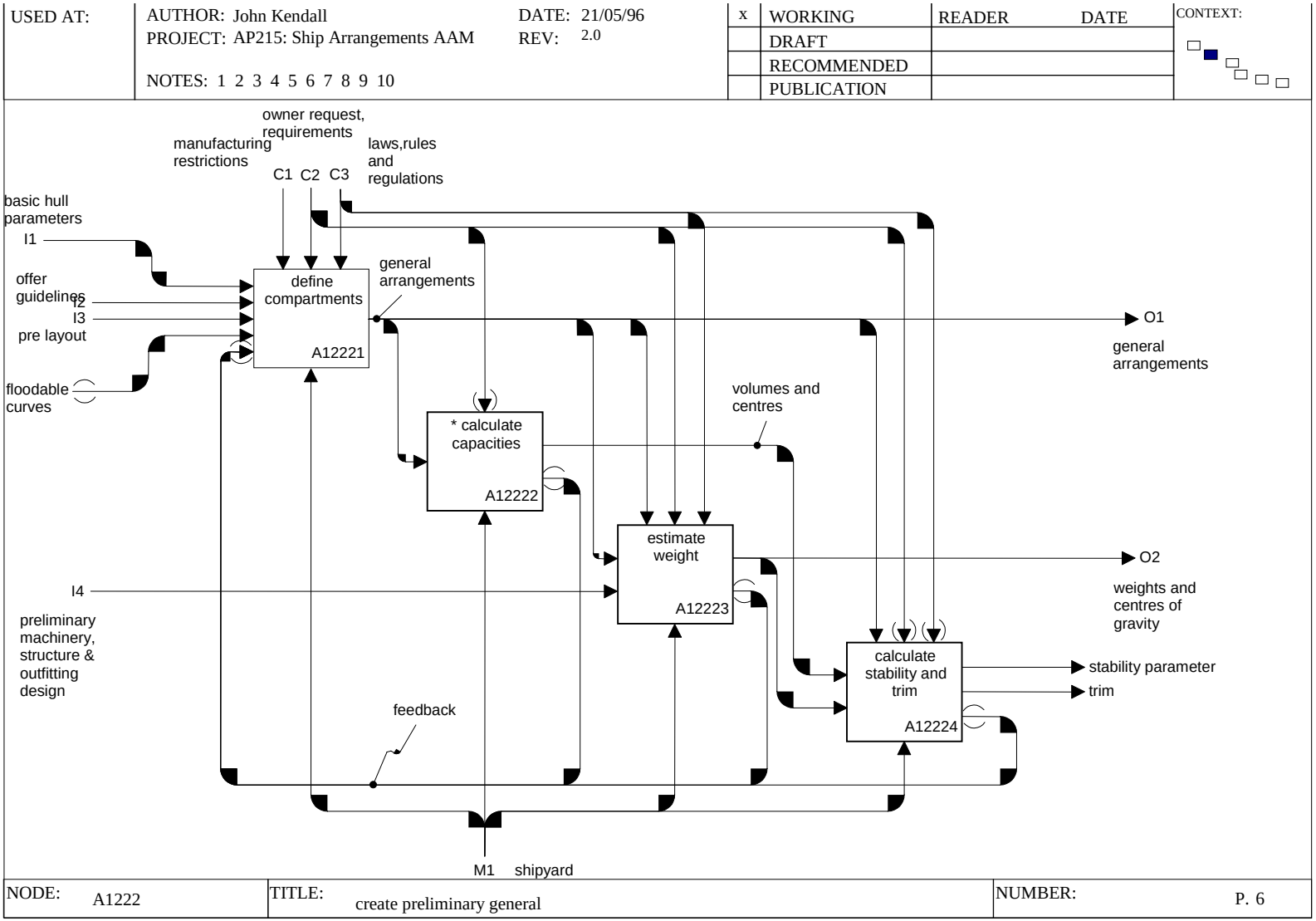

Figure F.6 - Ship general arrangements

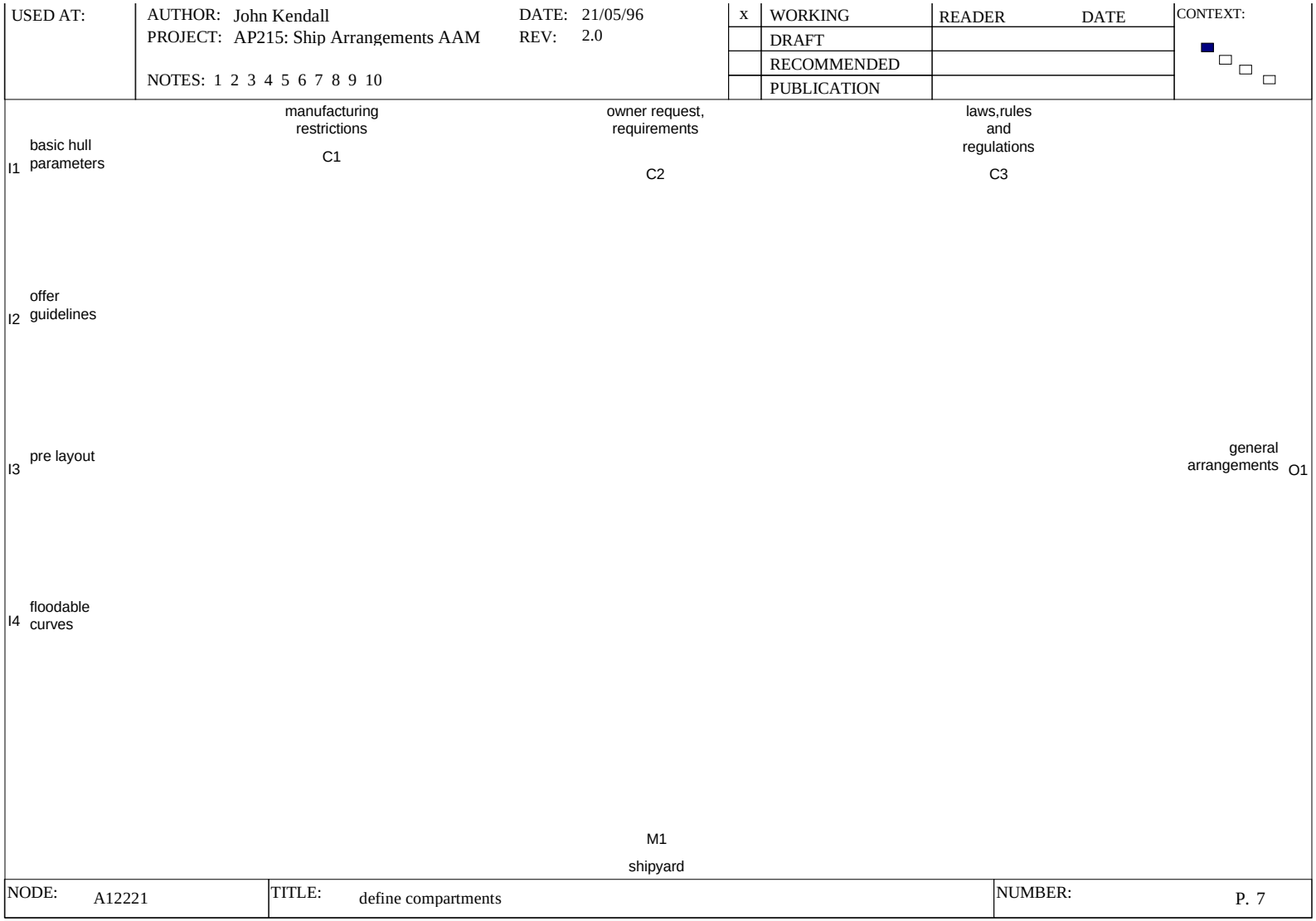

Figure F.7 - Define compartments

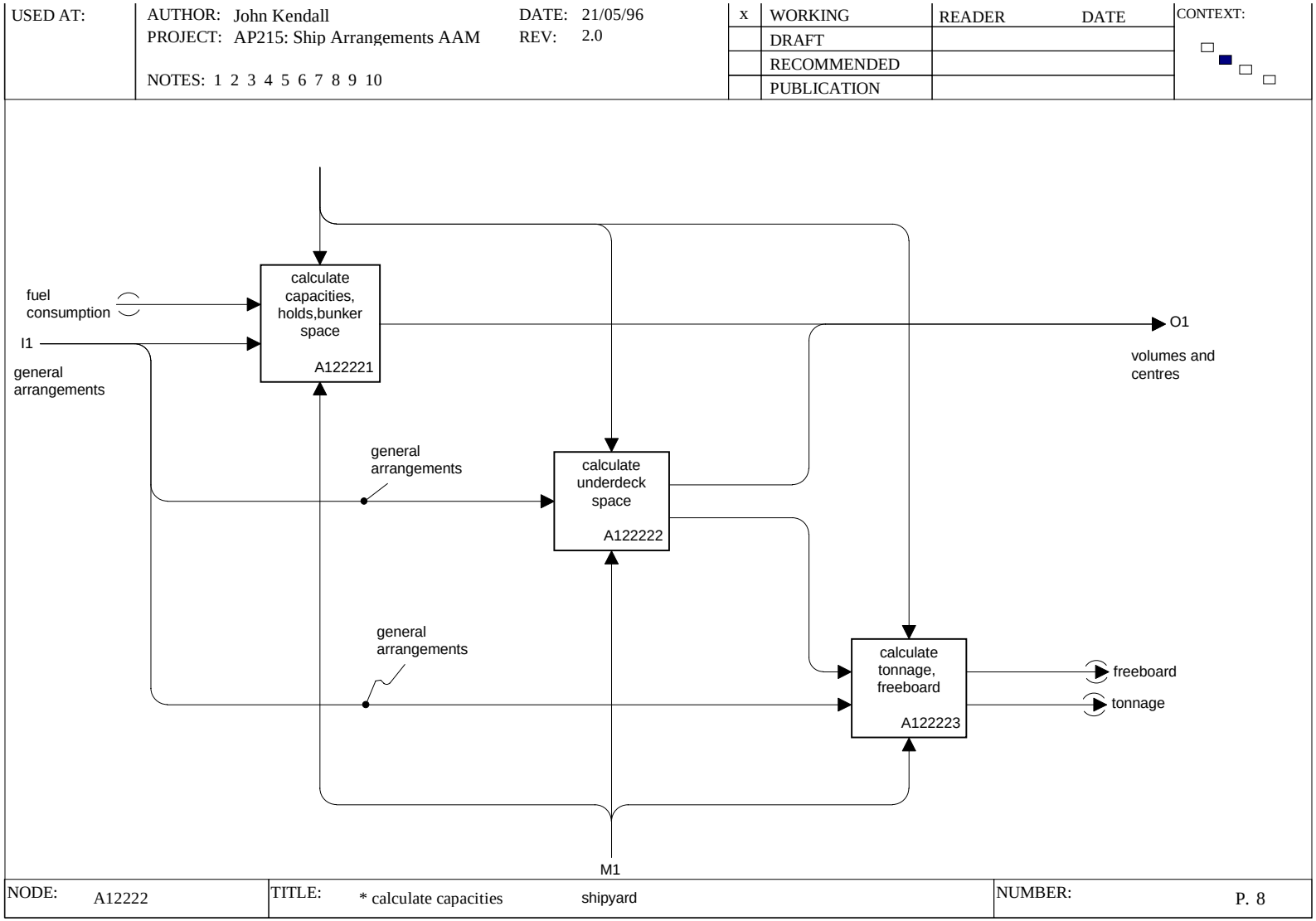

Figure F.8 - Calculate capacities

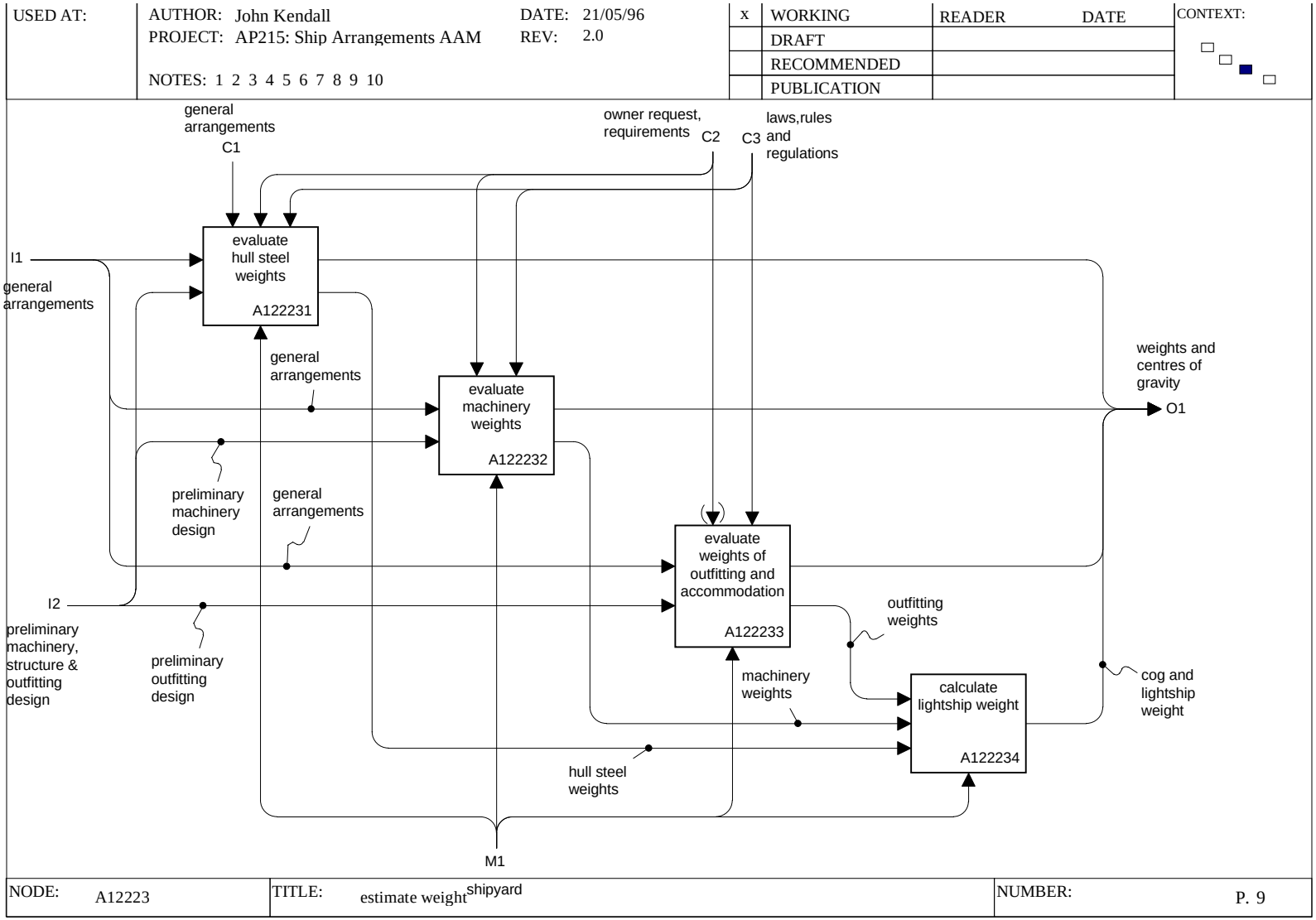

Figure F.9 - Estimate weight

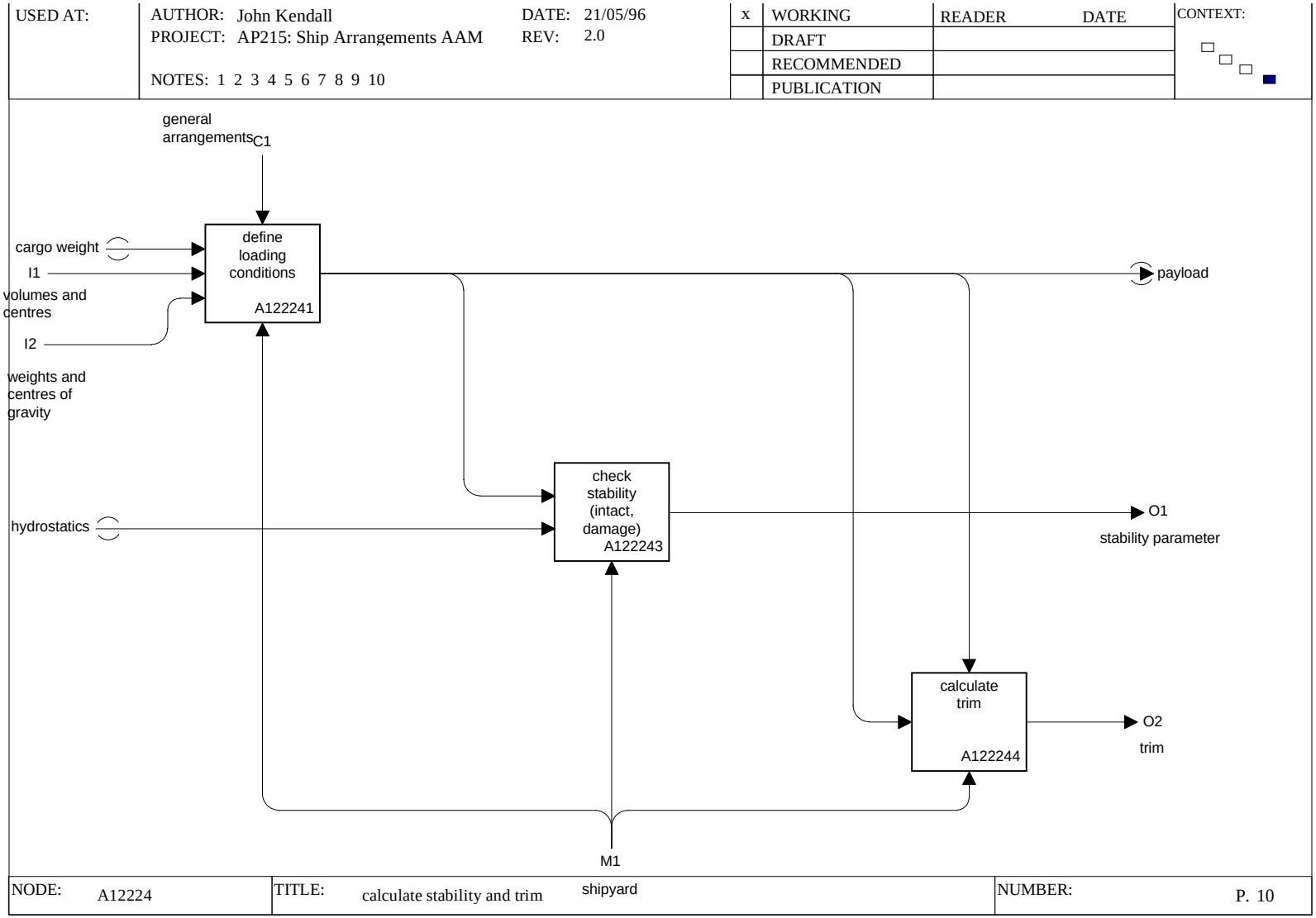

Figure F.10 - Calculate stability and trim

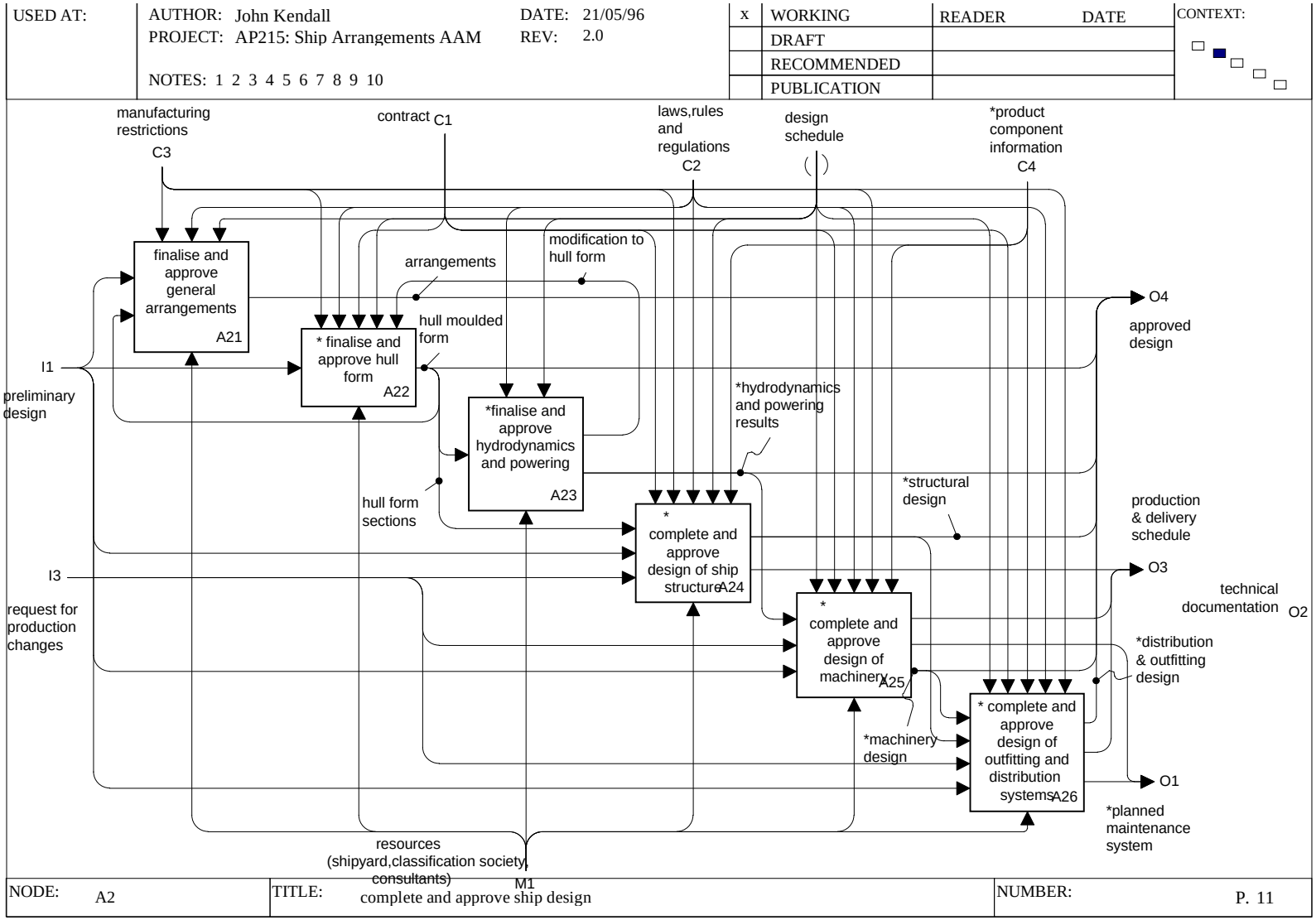

Figure F.11 - Complete and approve ship design

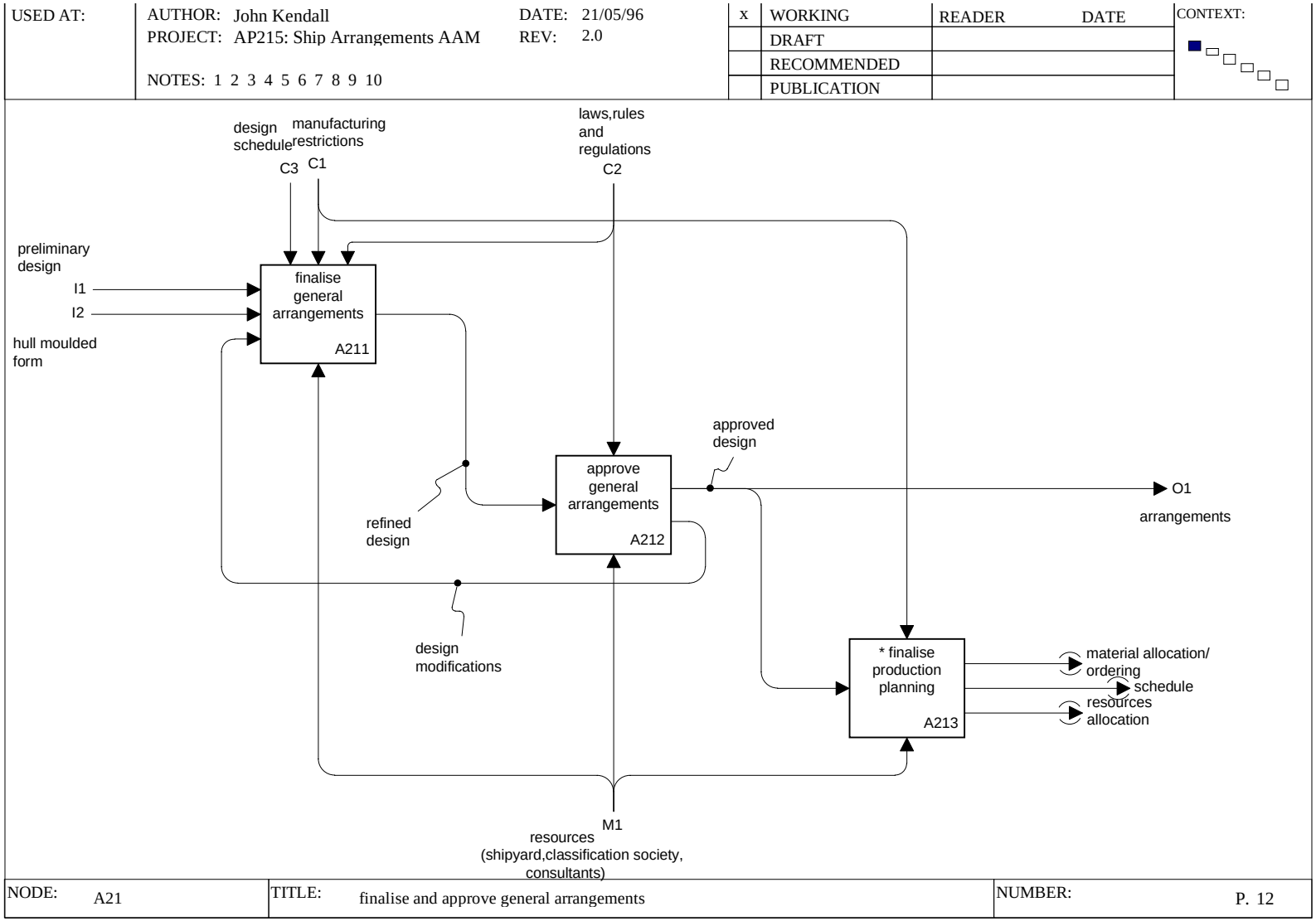

Figure F.12 - Finalise and approve general arrangements

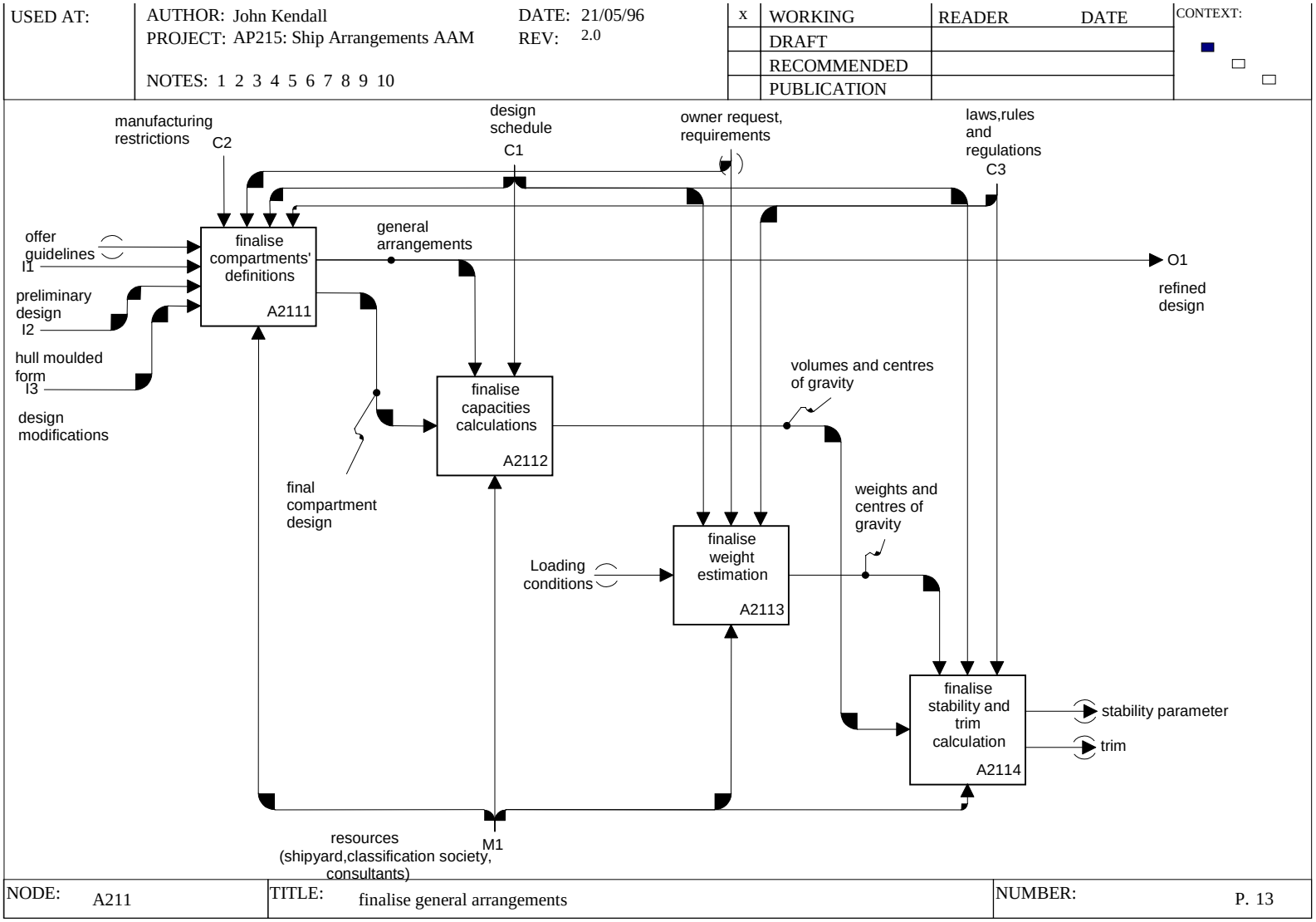

Figure F.13 - Finalise general arrangements

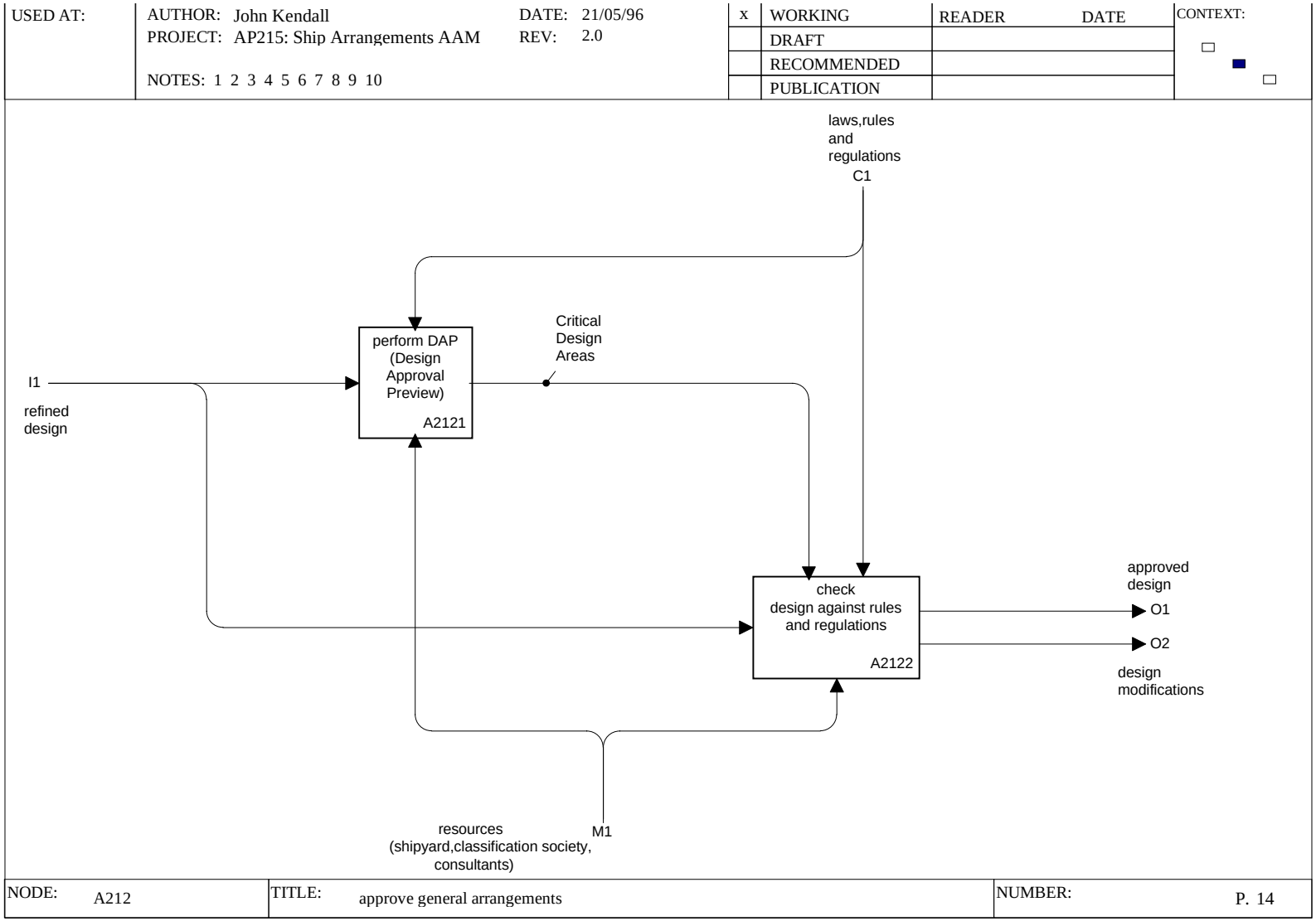

Figure F.14 - Approve general arrangements

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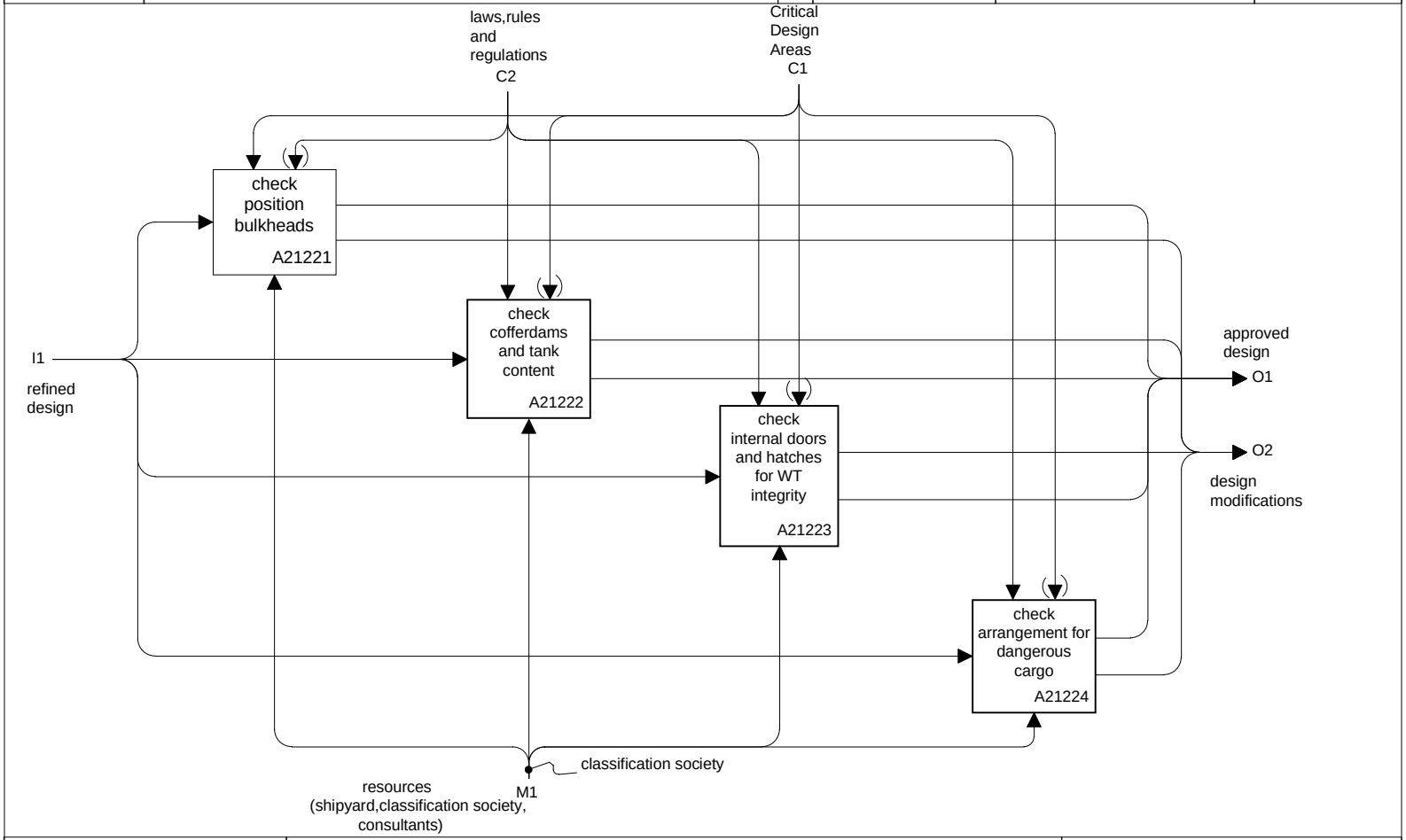

NODE: A2122	TITLE: check design against rules and regulations	NUMBER: P. 15

Figure F.15 - Check design against rules and regulations

Annex G
(informative)

Application Reference Model

This annex provides the application reference model for this part of ISO 10303. The application reference model is a graphical representation of the structure and constraints of the application objects specified in clause 4. The graphical form of the application reference model is presented in EXPRESS-G. The application reference model is independent from any implementation method. EXPRESS-G is defined in annex D of ISO 10303-11.

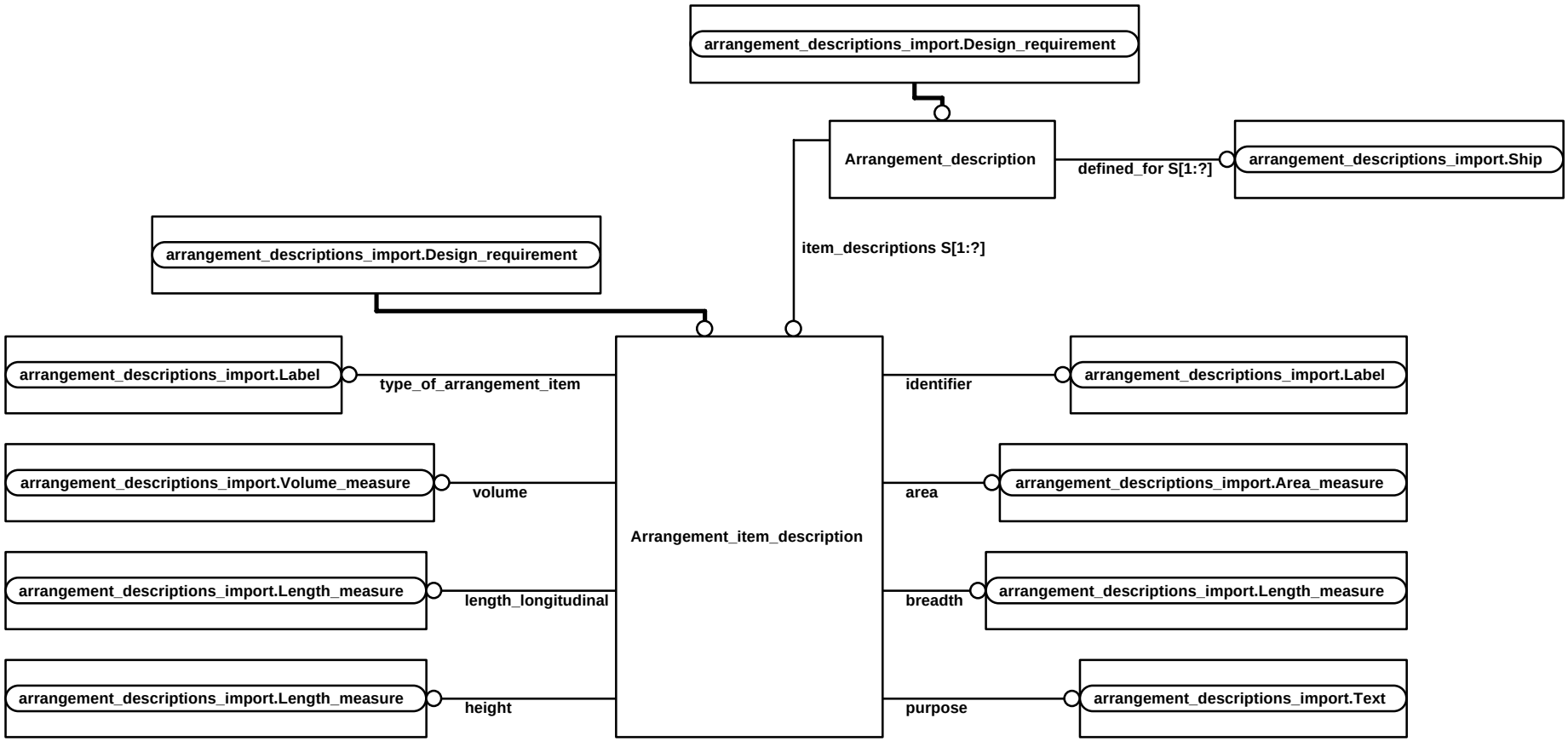

Figure G.1 - ARM diagram - arrangement_descriptions UoF (figure 1 of 1)

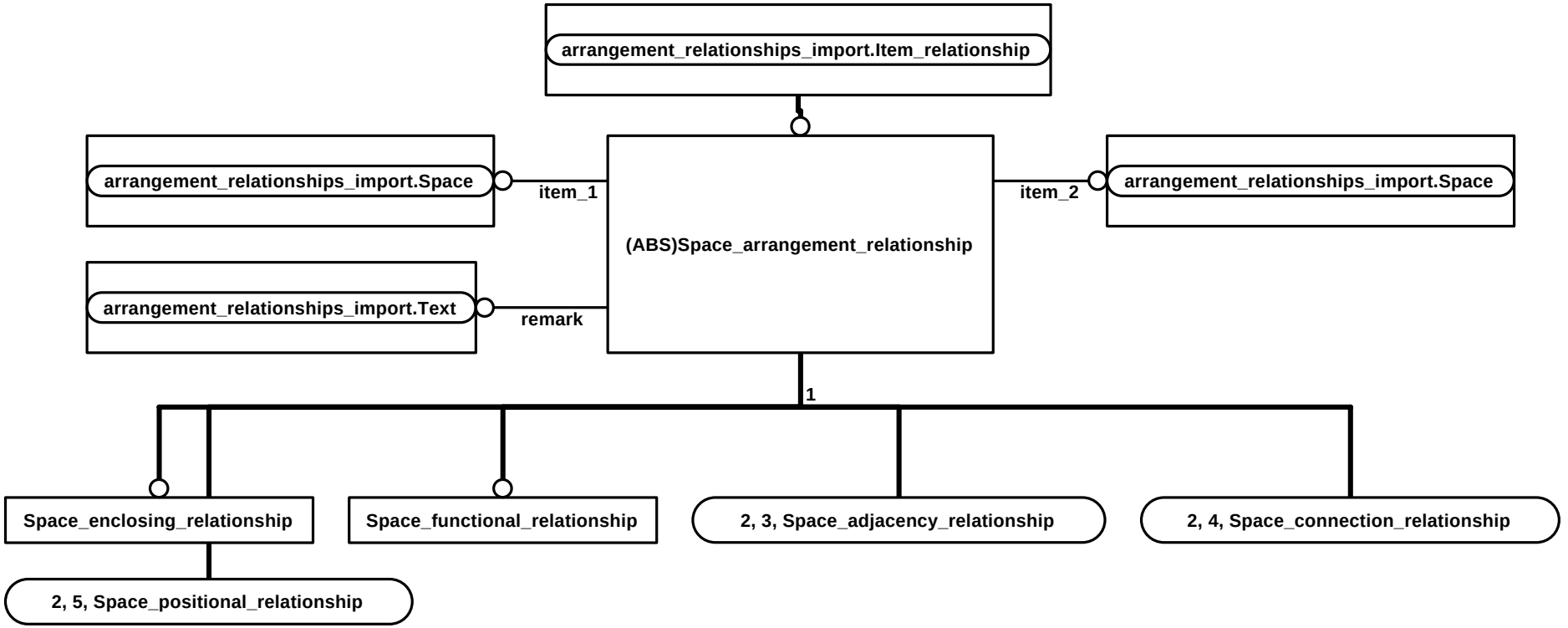

Figure G.2 - ARM diagram - arrangement_relationships UoF (figure 1 of 2)

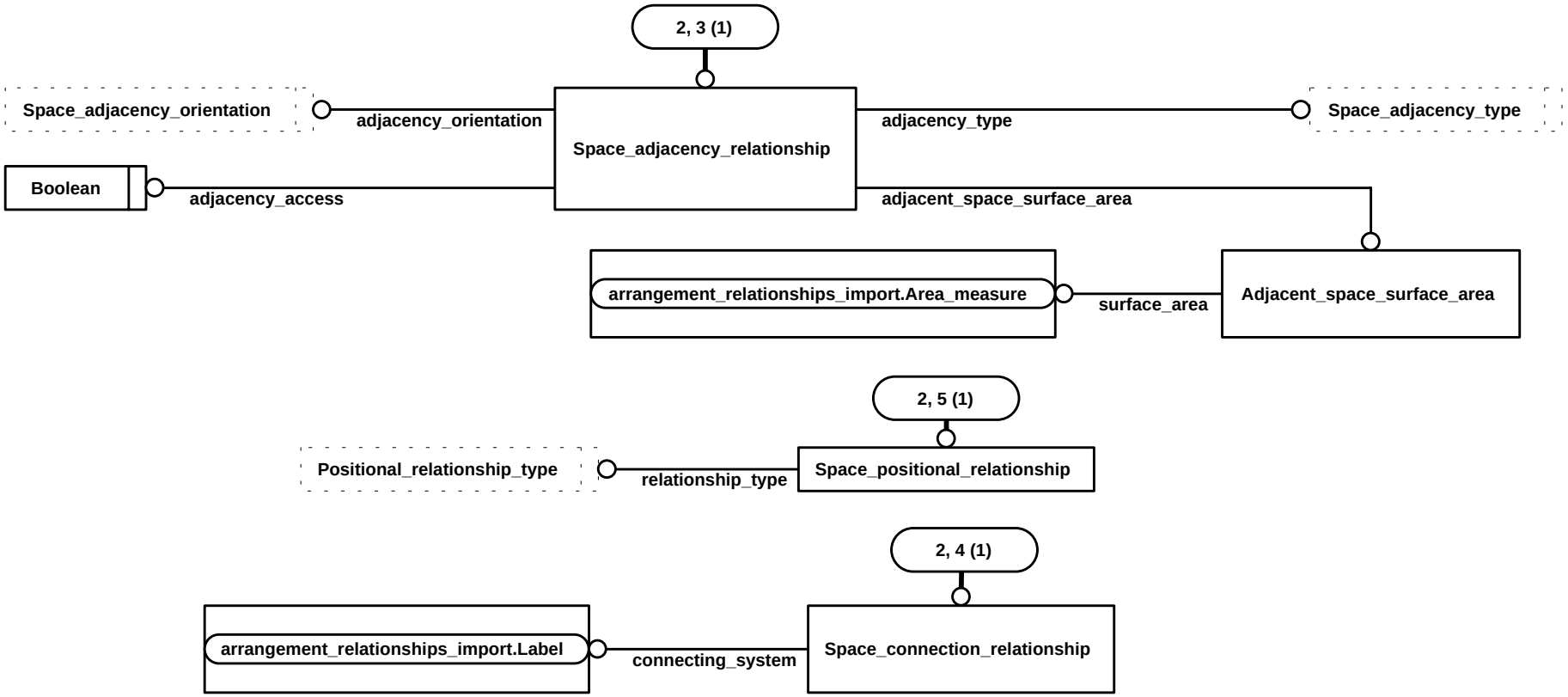

Figure G.3 - ARM diagram - arrangement_relationships UoF (figure 2 of 2)

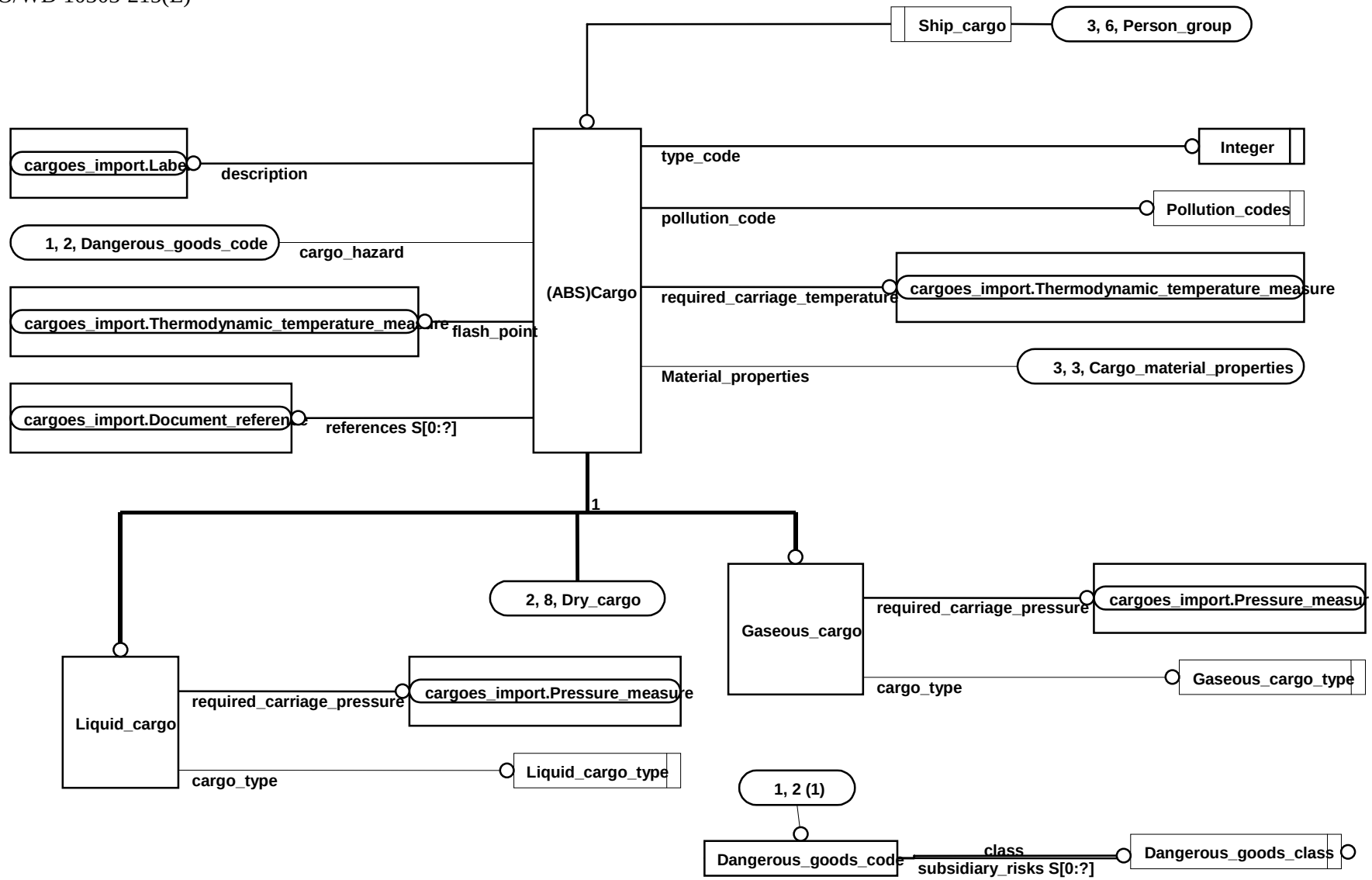

Figure G.4 - ARM diagram - cargoes UoF (figure 1 of 5)

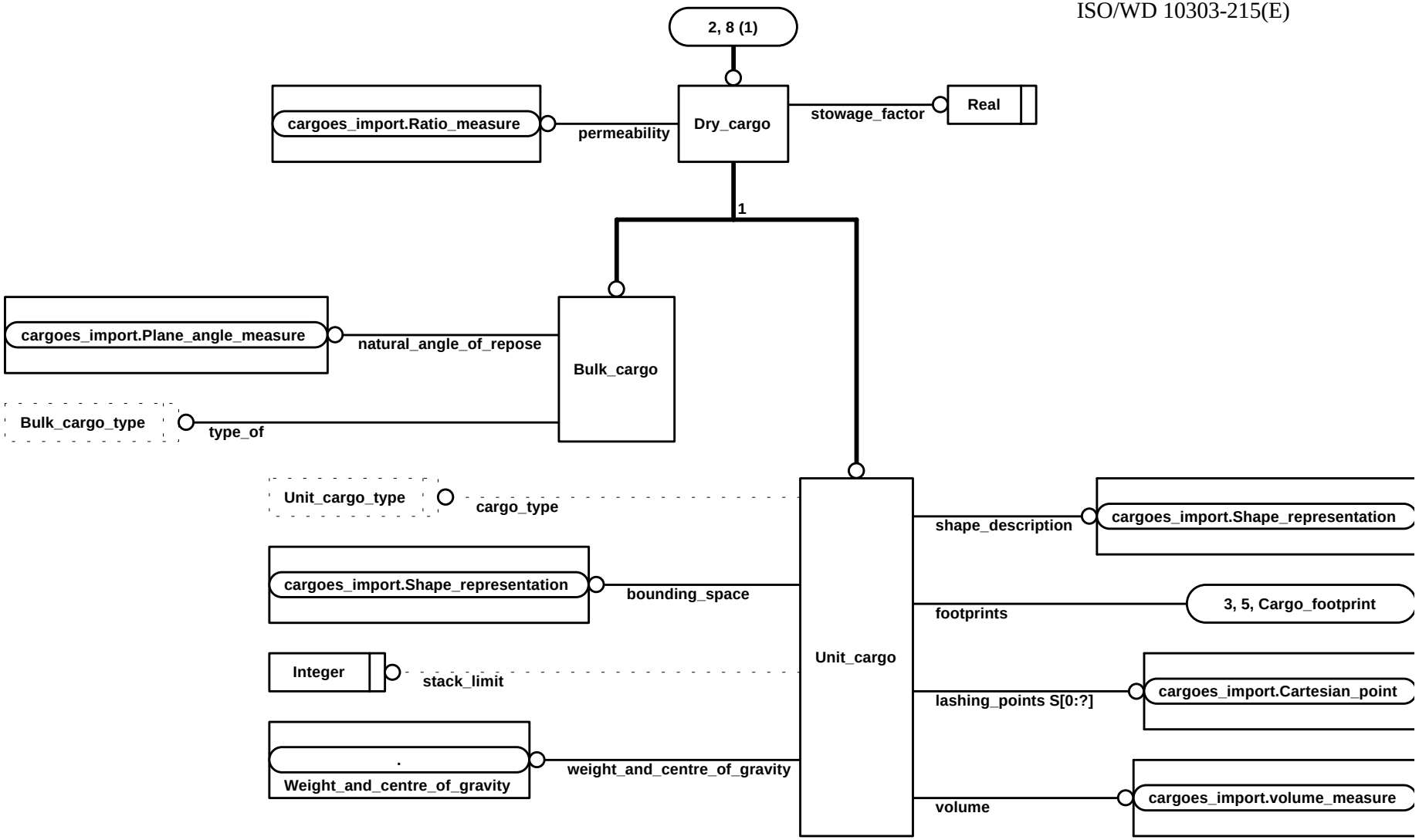

Figure G.5 - ARM diagram - cargoes UoF (figure 2 of 5)

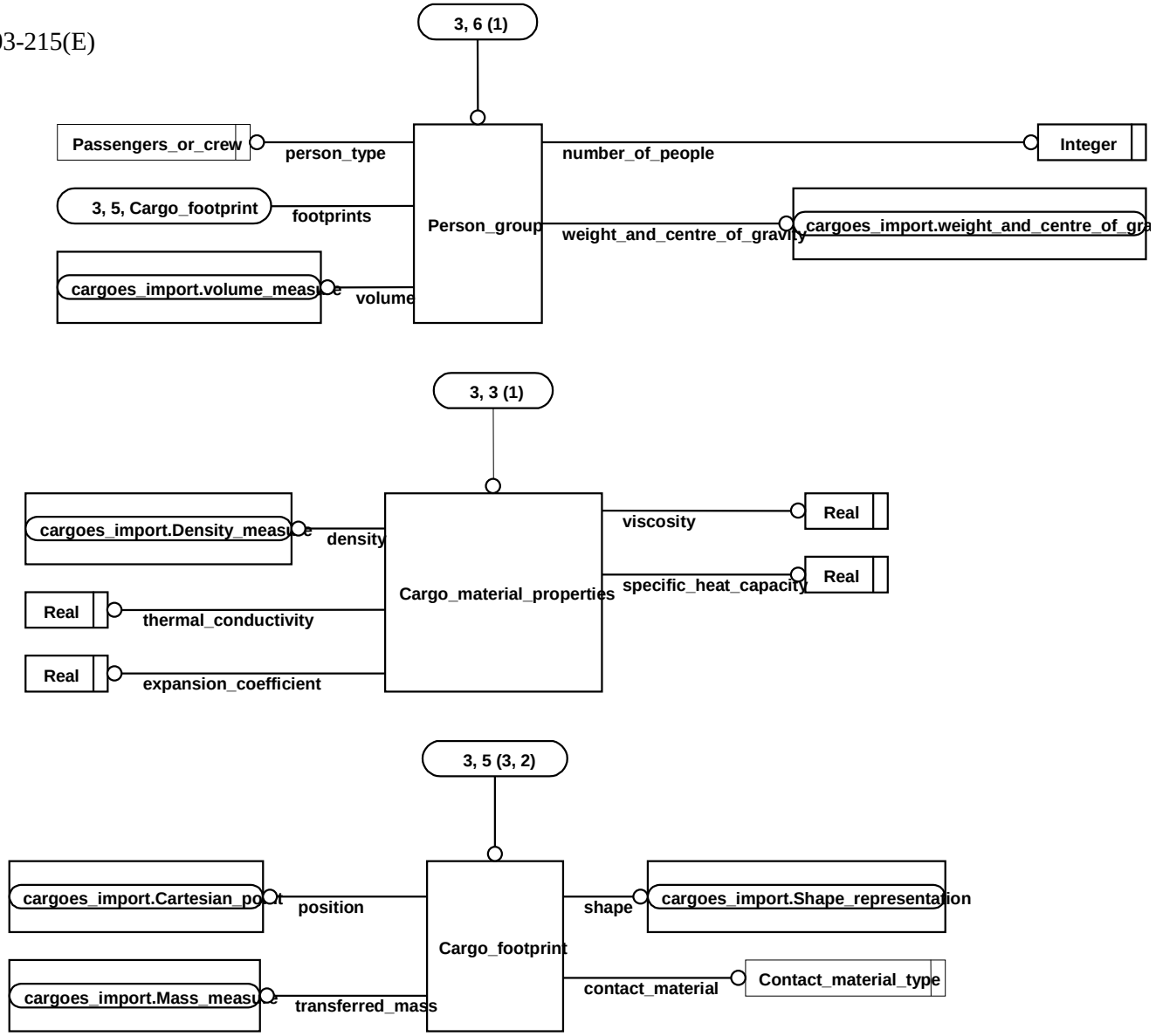

Figure G.6 - ARM diagram - cargoes UoF (figure 3 of 5)

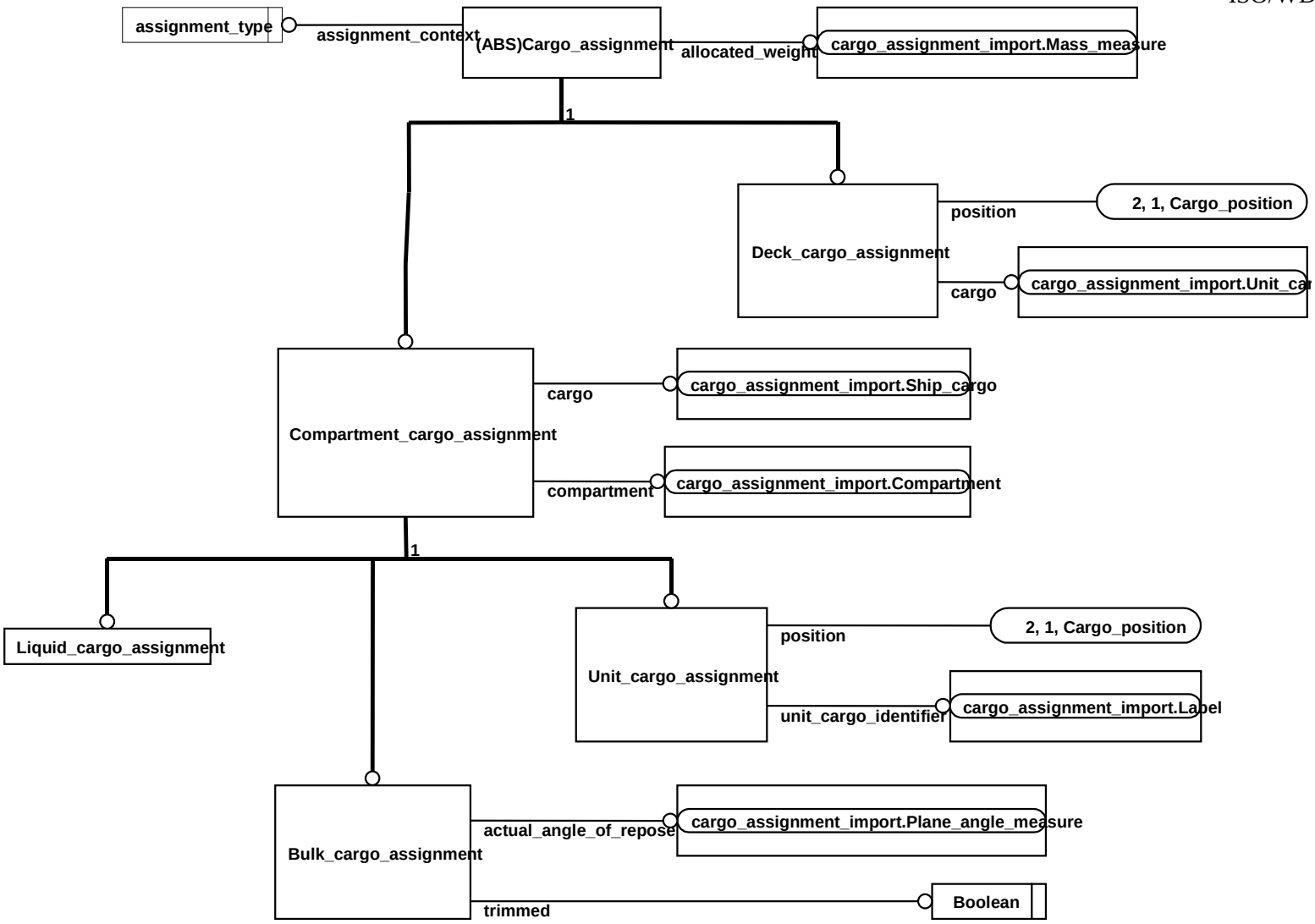

Figure G.7 - ARM diagram - cargoes UoF (figure 4 of 5)

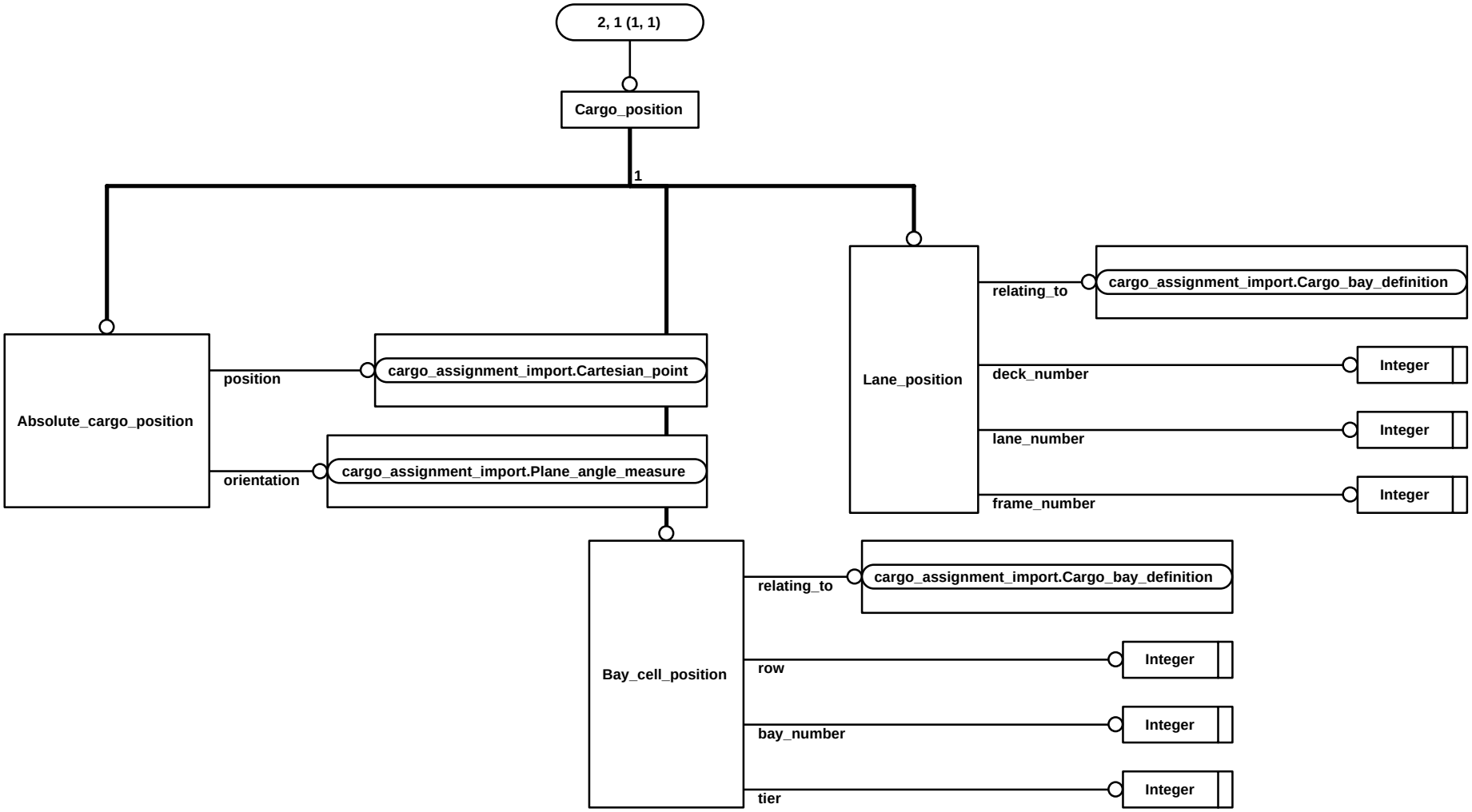

Figure G.8 - ARM diagram - cargoes UoF (figure 5 of 5)

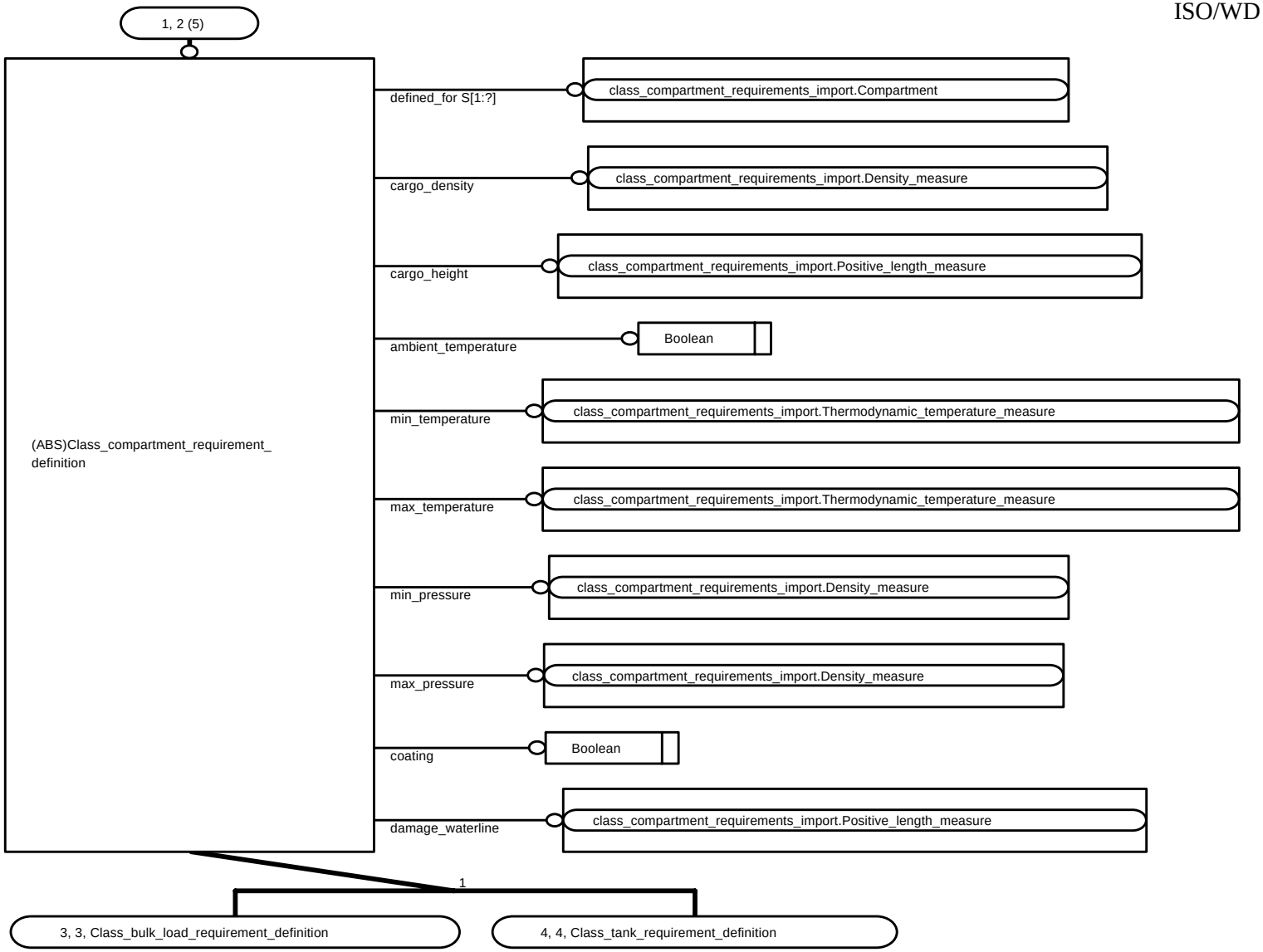

Figure G.9 - ARM diagram - class_compartment_requirements UoF (figure 1 of 3)

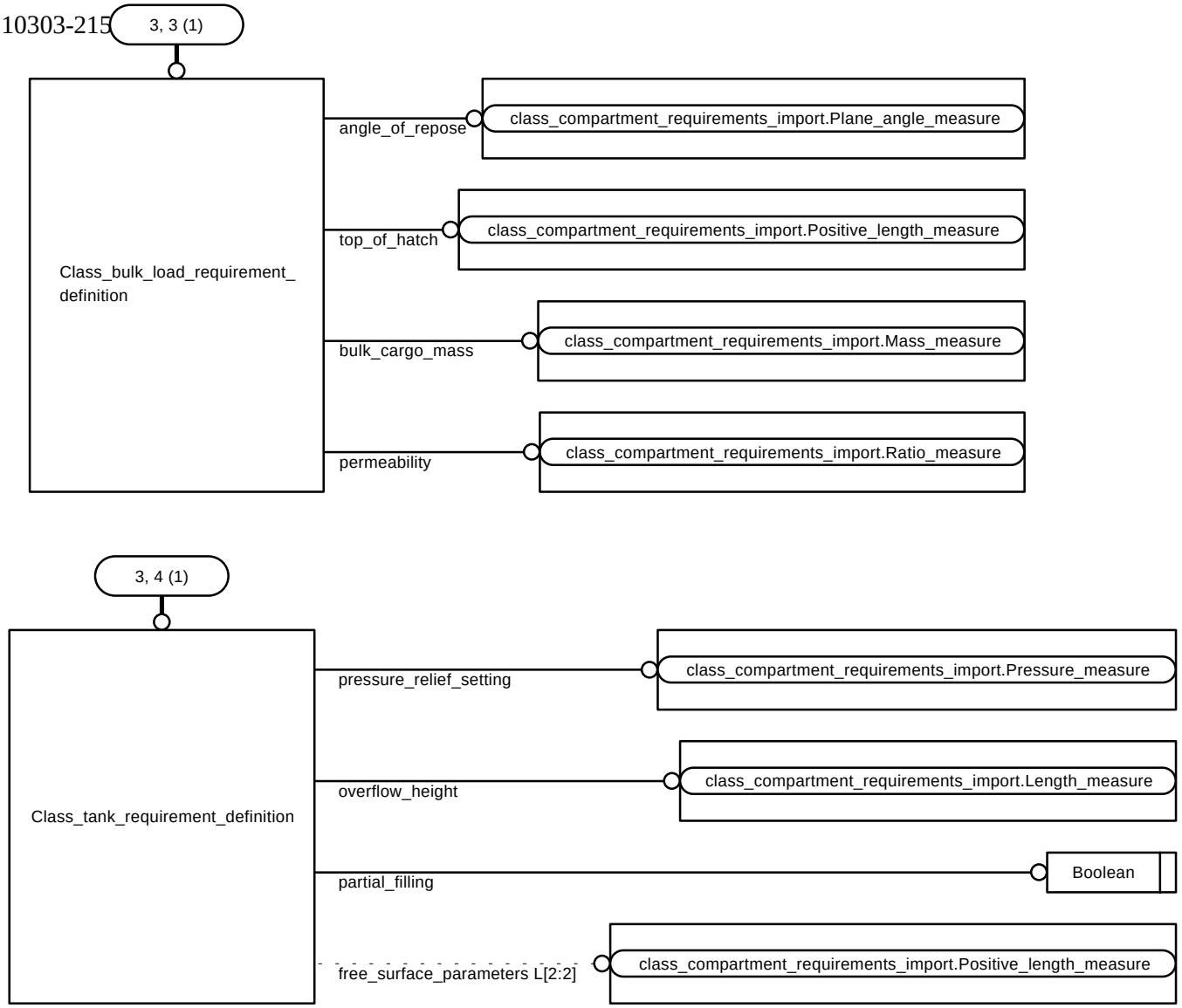

Figure G.10 - ARM diagram - class_compartment_requirements UoF (figure 2 of 3)

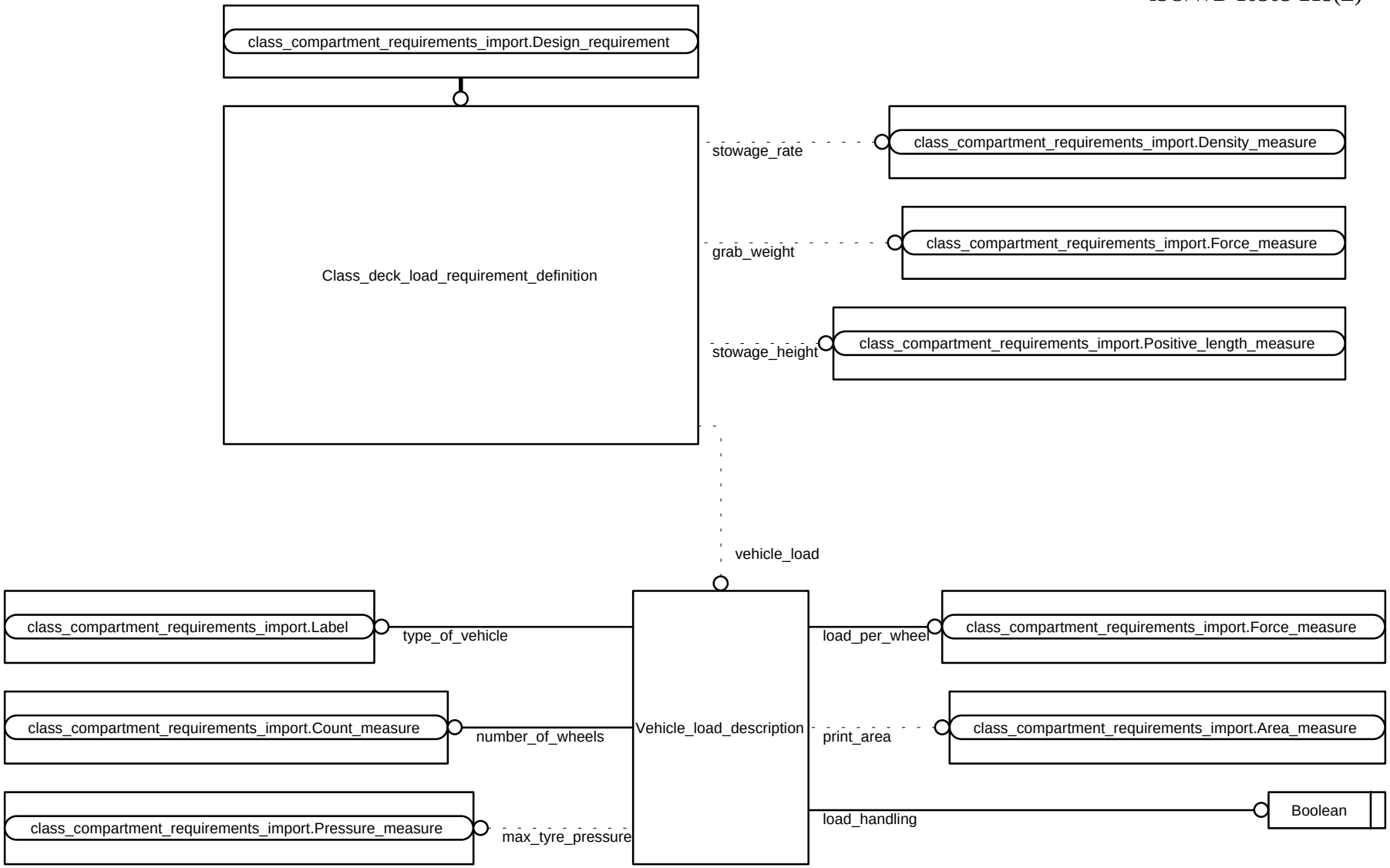

Figure G.11 - ARM diagram - class_compartment_requirements UoF (figure 3 of 3)

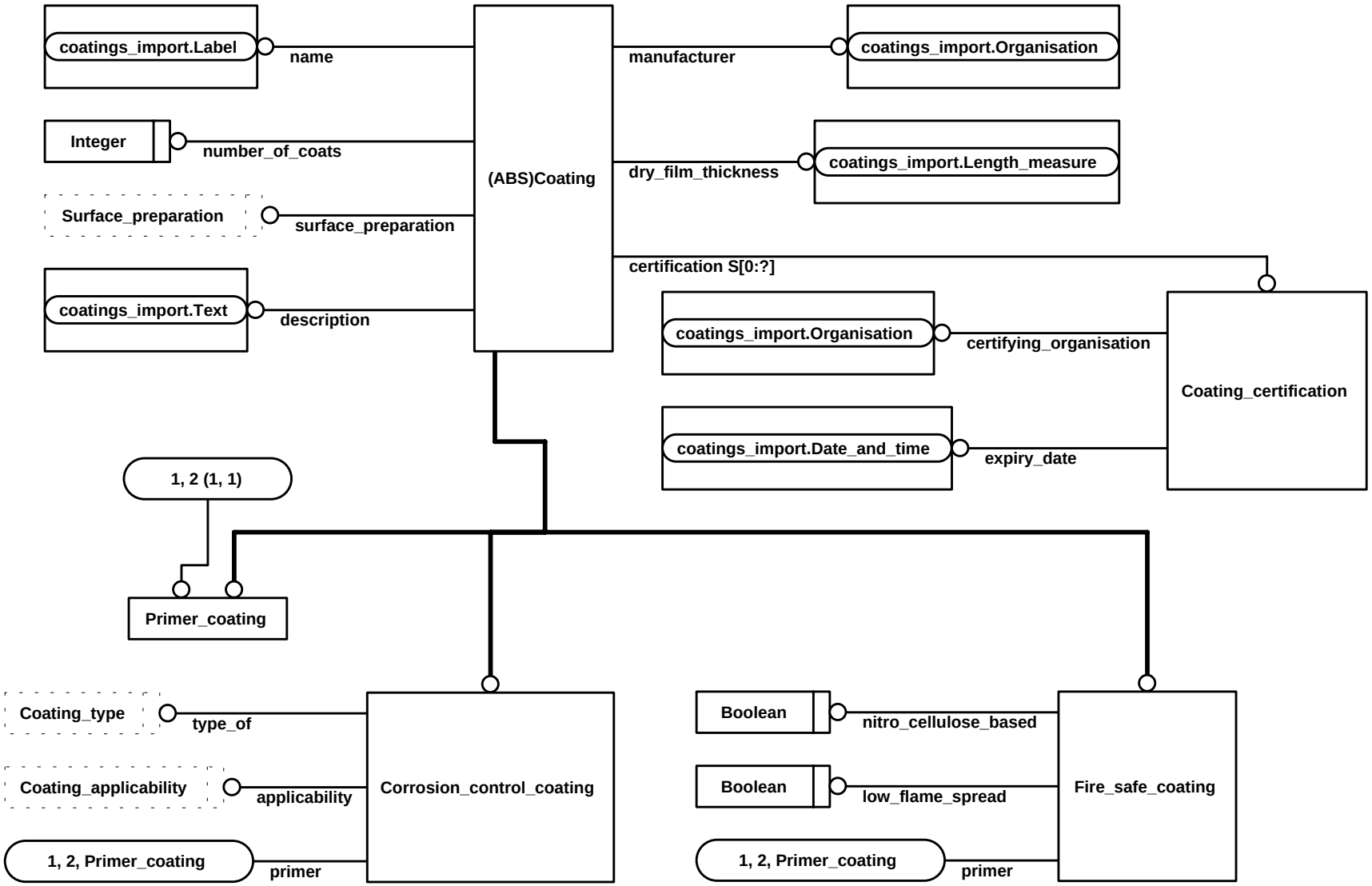

Figure G.12 - ARM diagram - coatings UoF (figure 1 of 1)

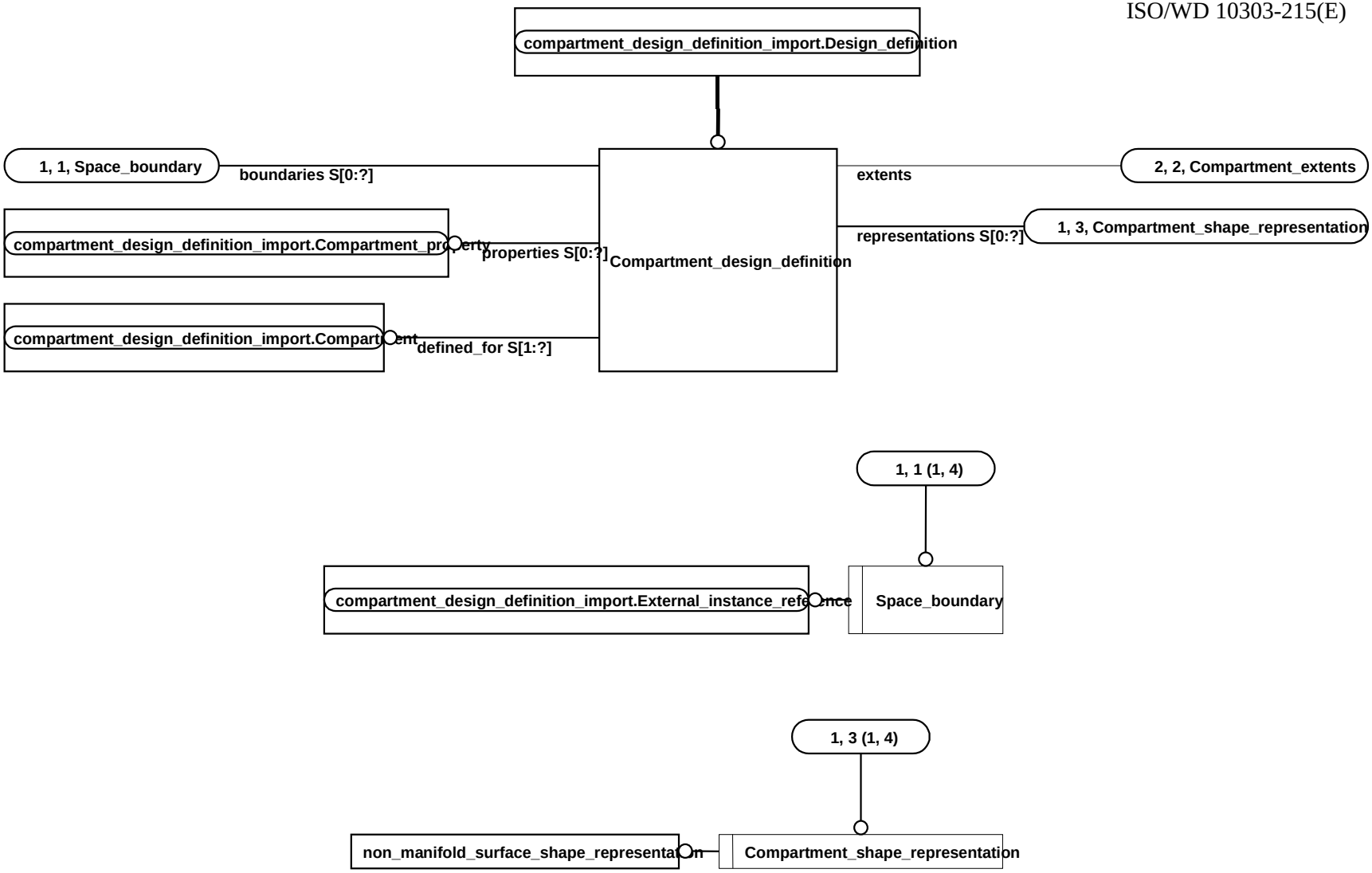

Figure G.13 - ARM diagram - compartment_design_definitions UoF (figure 1 of 3)

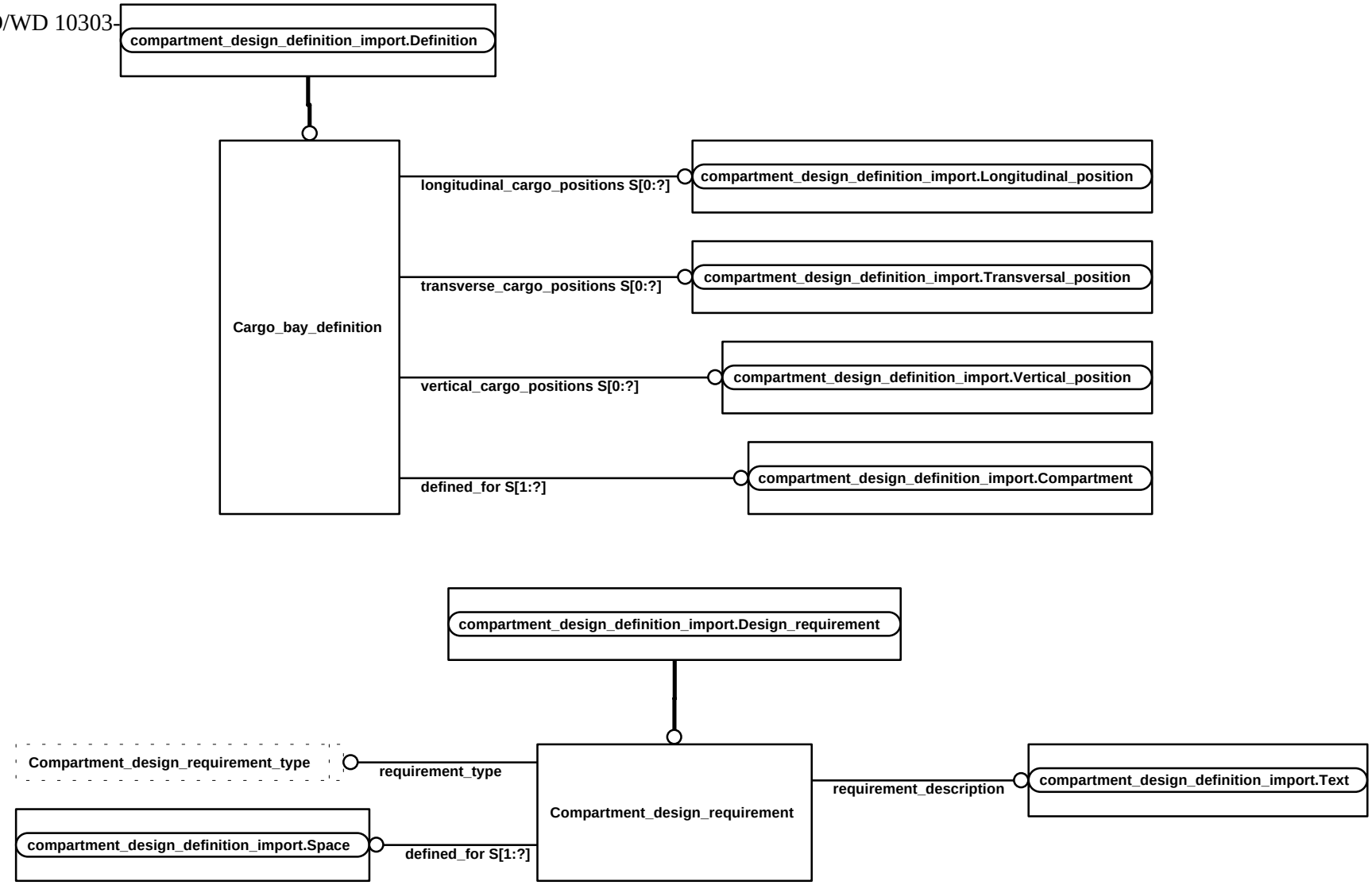

Figure G.14 - ARM diagram - compartment_design_definitions UoF (figure 2 of 3)

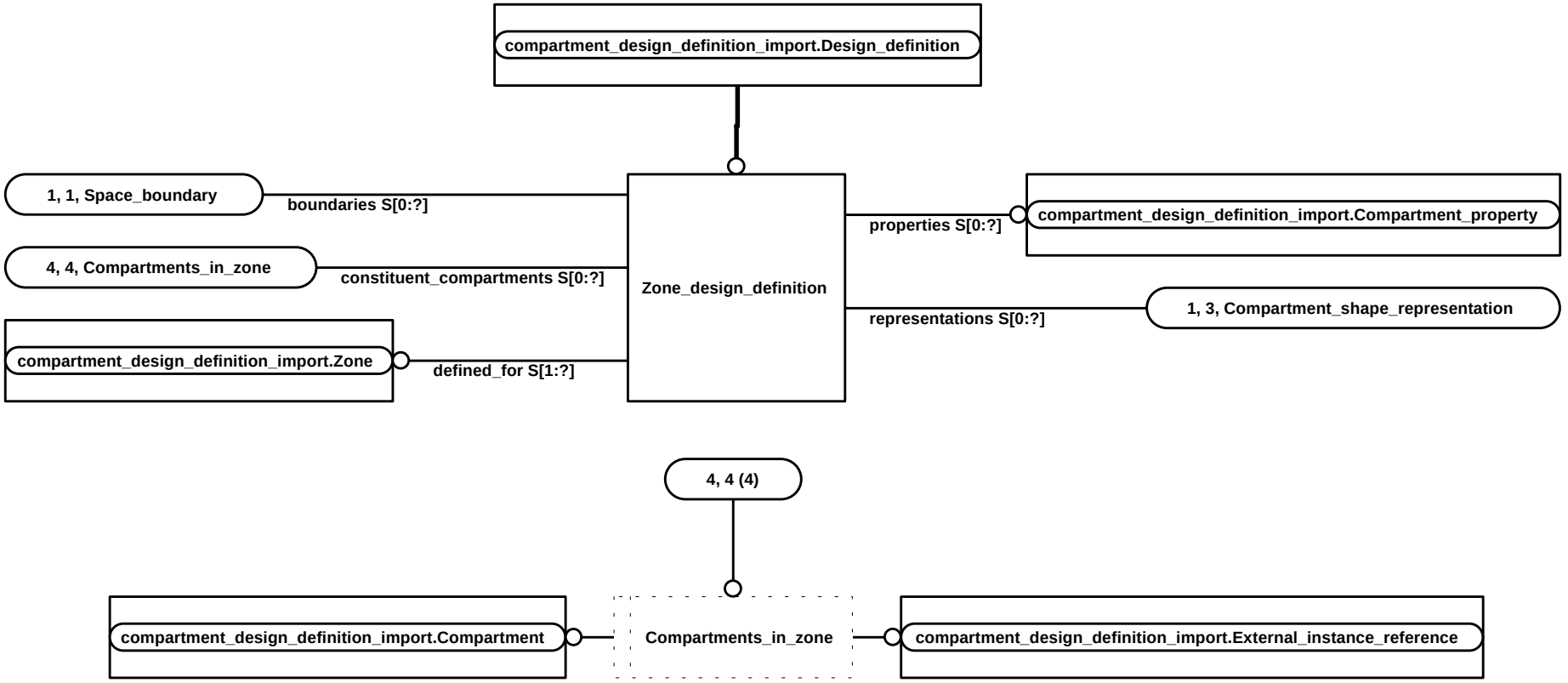

Figure G.15 - ARM diagram - compartment_design_definitions UoF (figure 3 of 3)

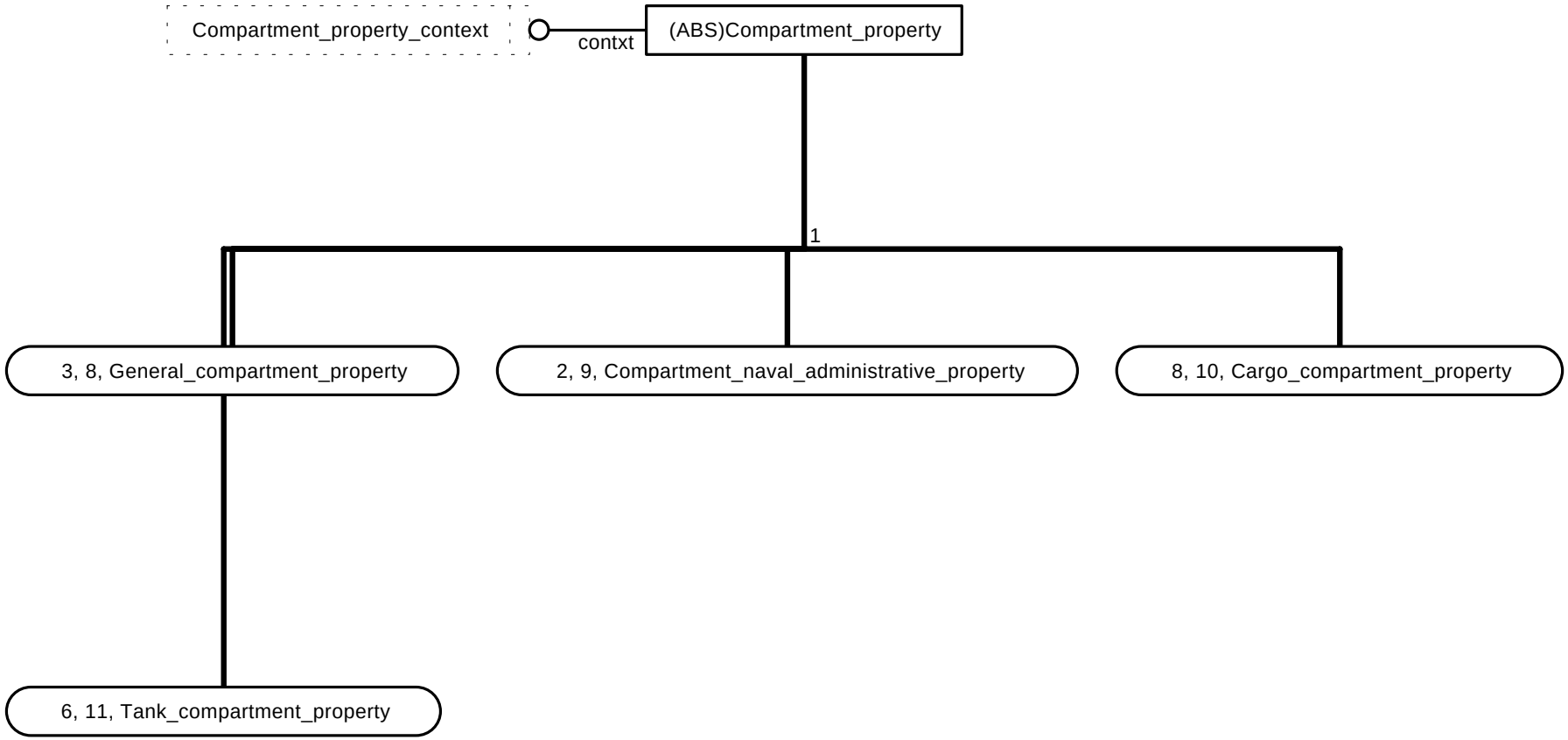

Figure G.16 - ARM diagram - compartment_properties UoF (figure 1 of 11)

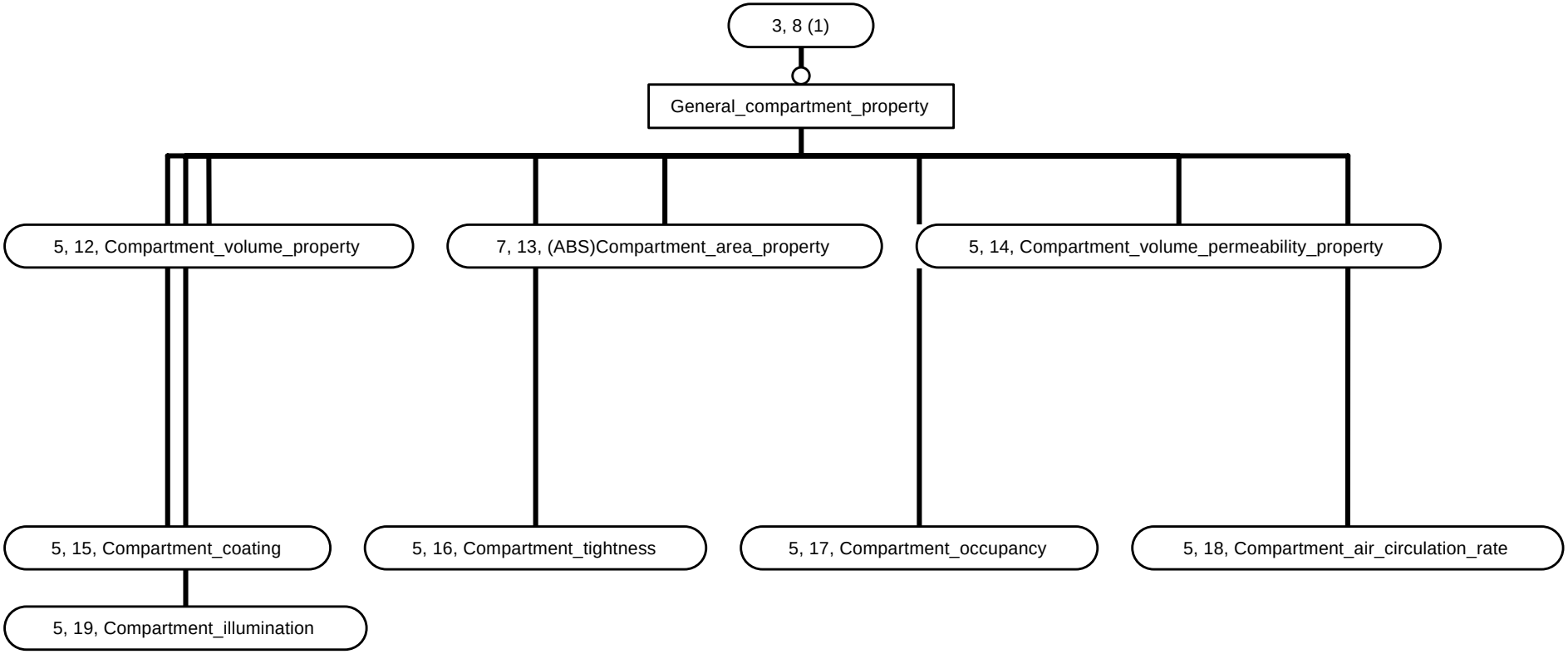

Figure G.17 - ARM diagram - compartment_properties UoF (figure 2 of 11)

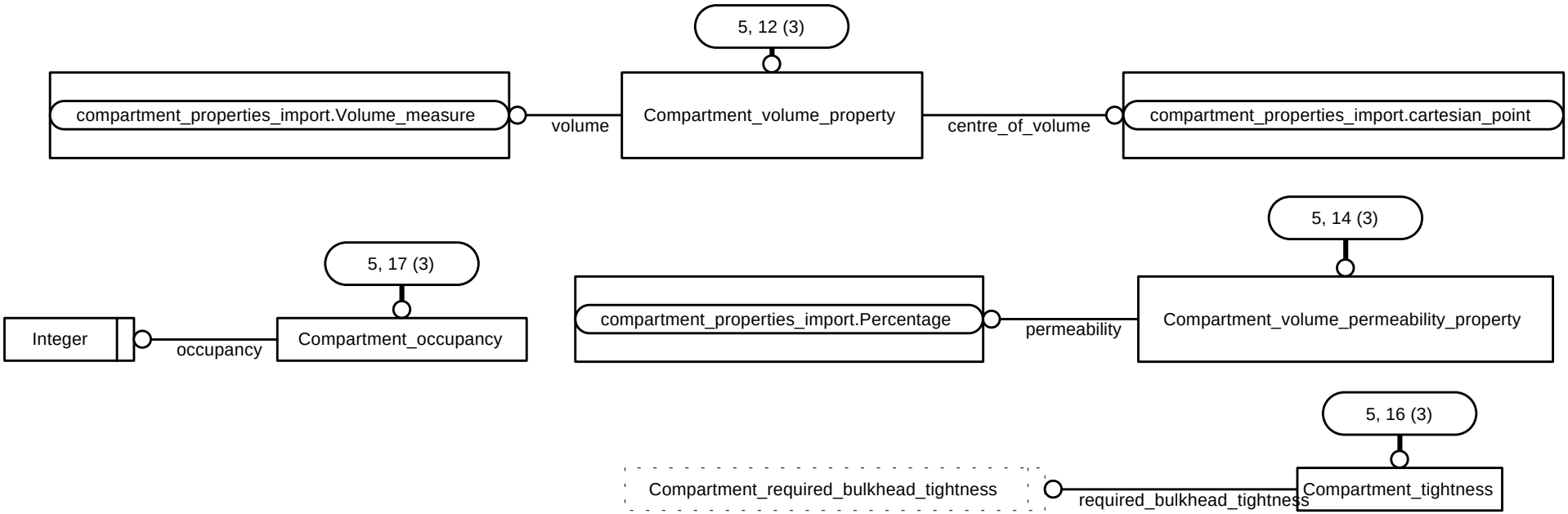

Figure G.18 - ARM diagram- compartment_properties UoF (figure 3 of 11)

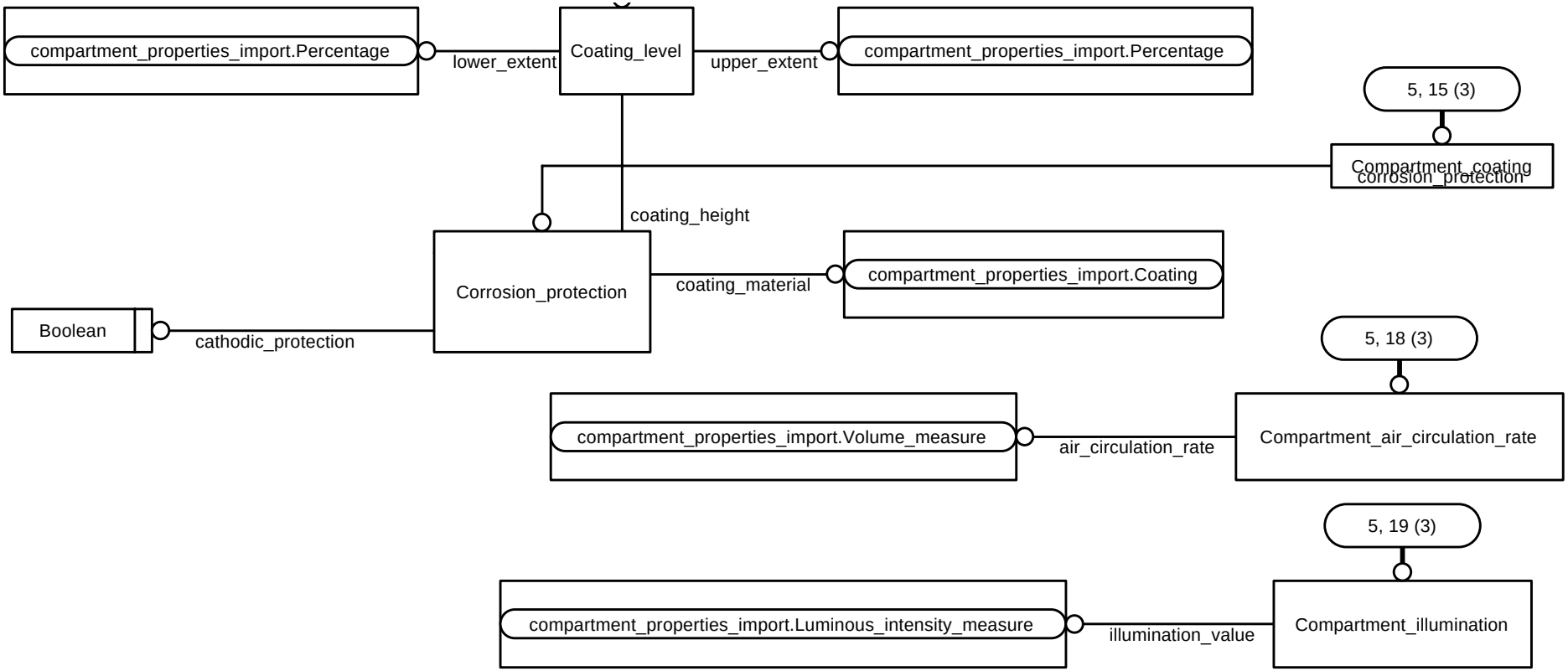

Figure G.19 - ARM diagram - compartment_properties UoF (figure 4 of 11)

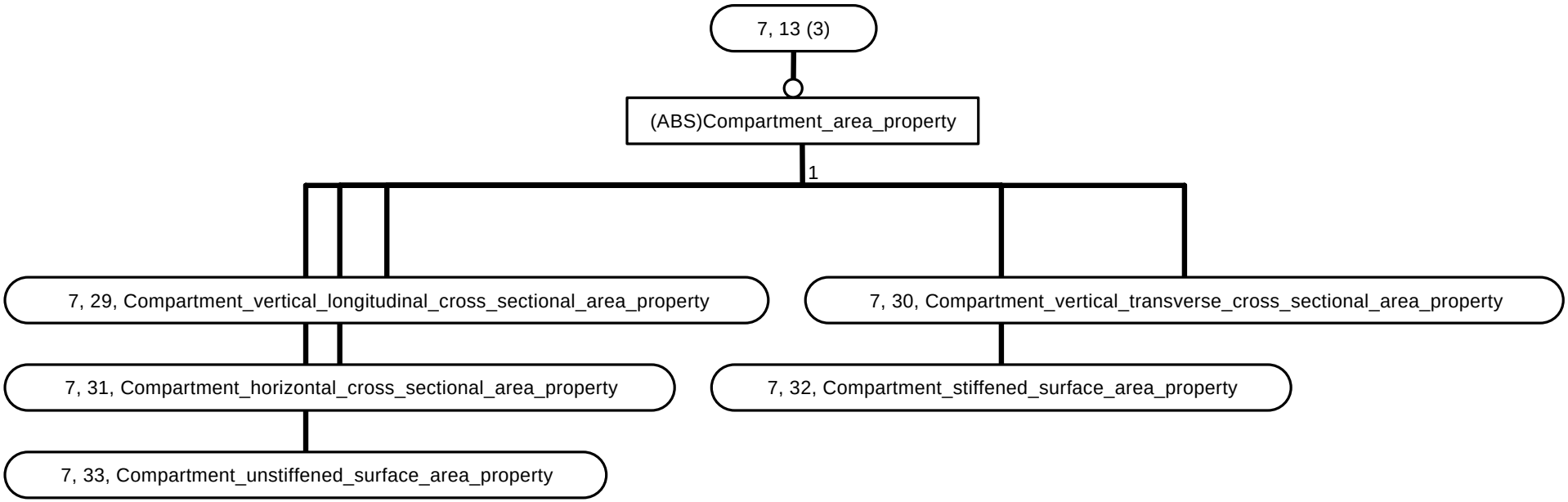

Figure G.20 - ARM diagram - compartment_properties UoF (figure 5 of 11)

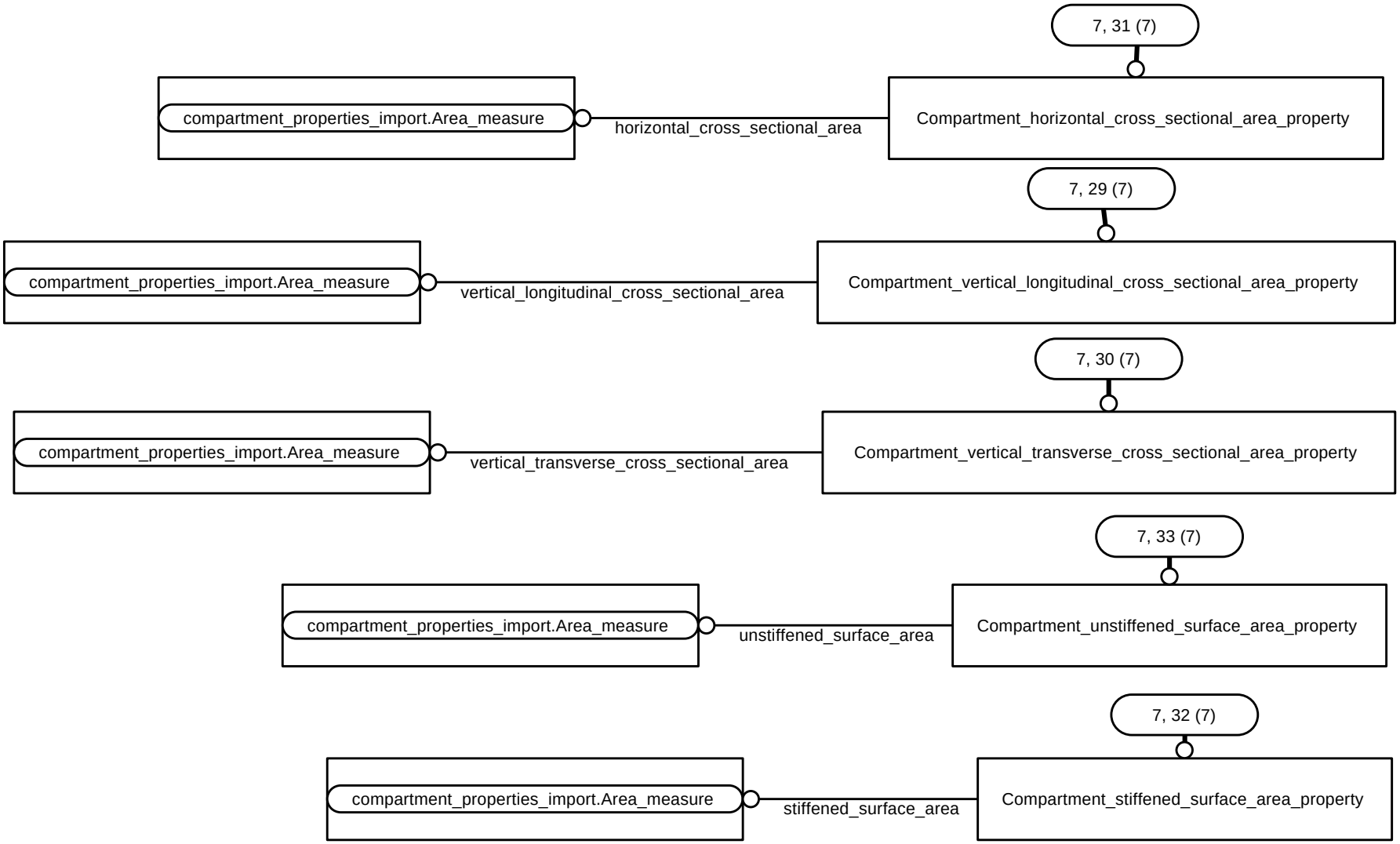

Figure G.21 - ARM diagram - compartment_properties UoF (figure 6 of 11)

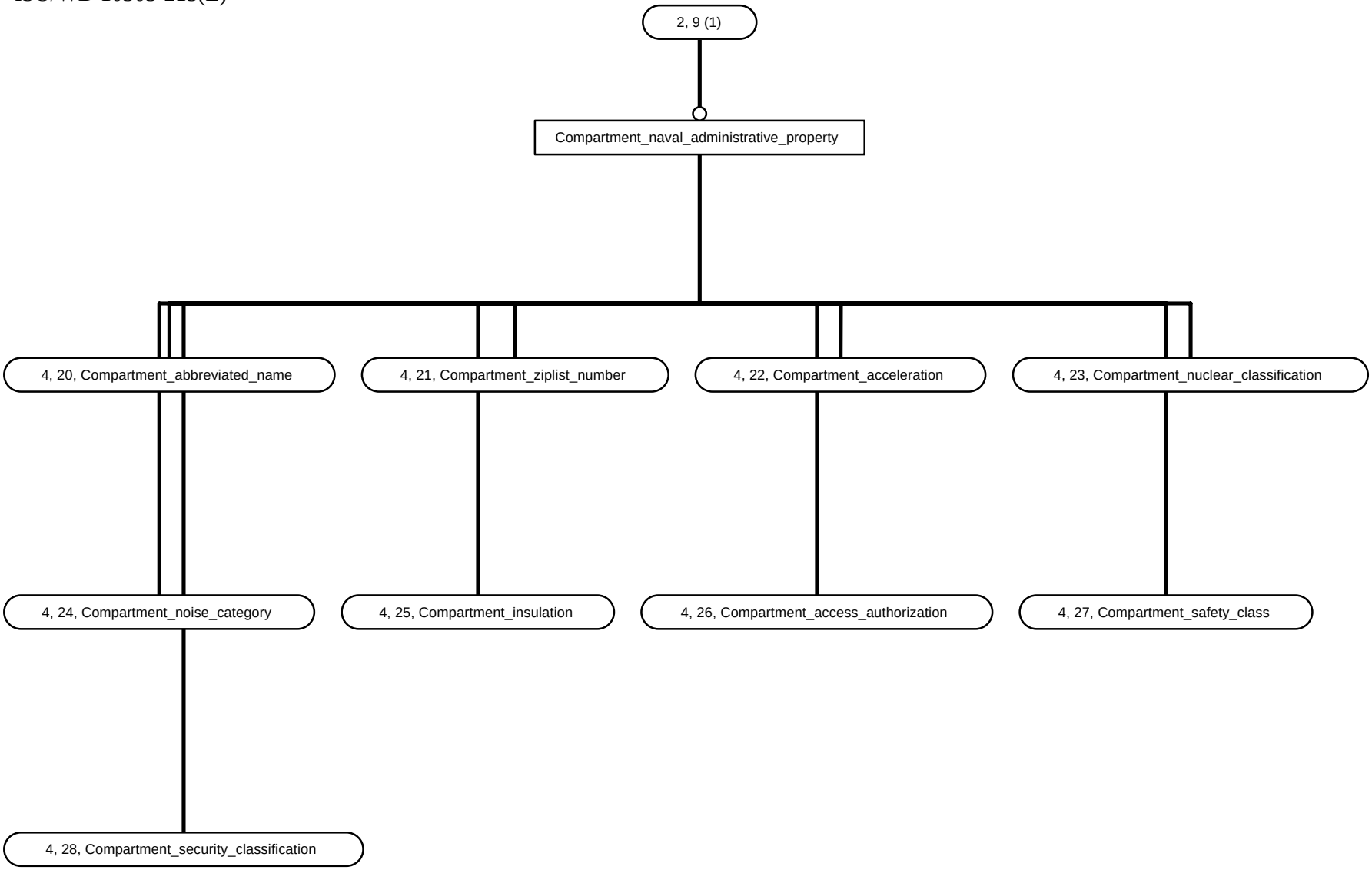

Figure G.22 - ARM diagram - compartment_properties UoF (figure 7 of 11)

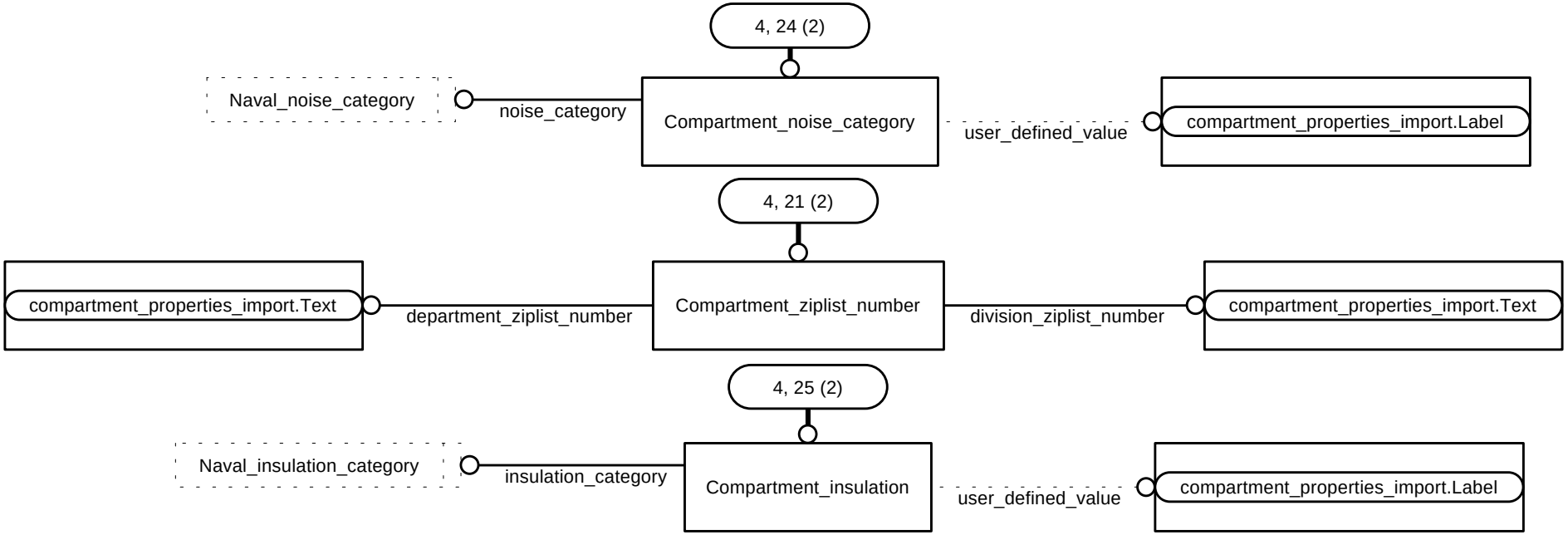

Figure G.23 - ARM diagram - compartment_properties UoF (figure 8 of 11)

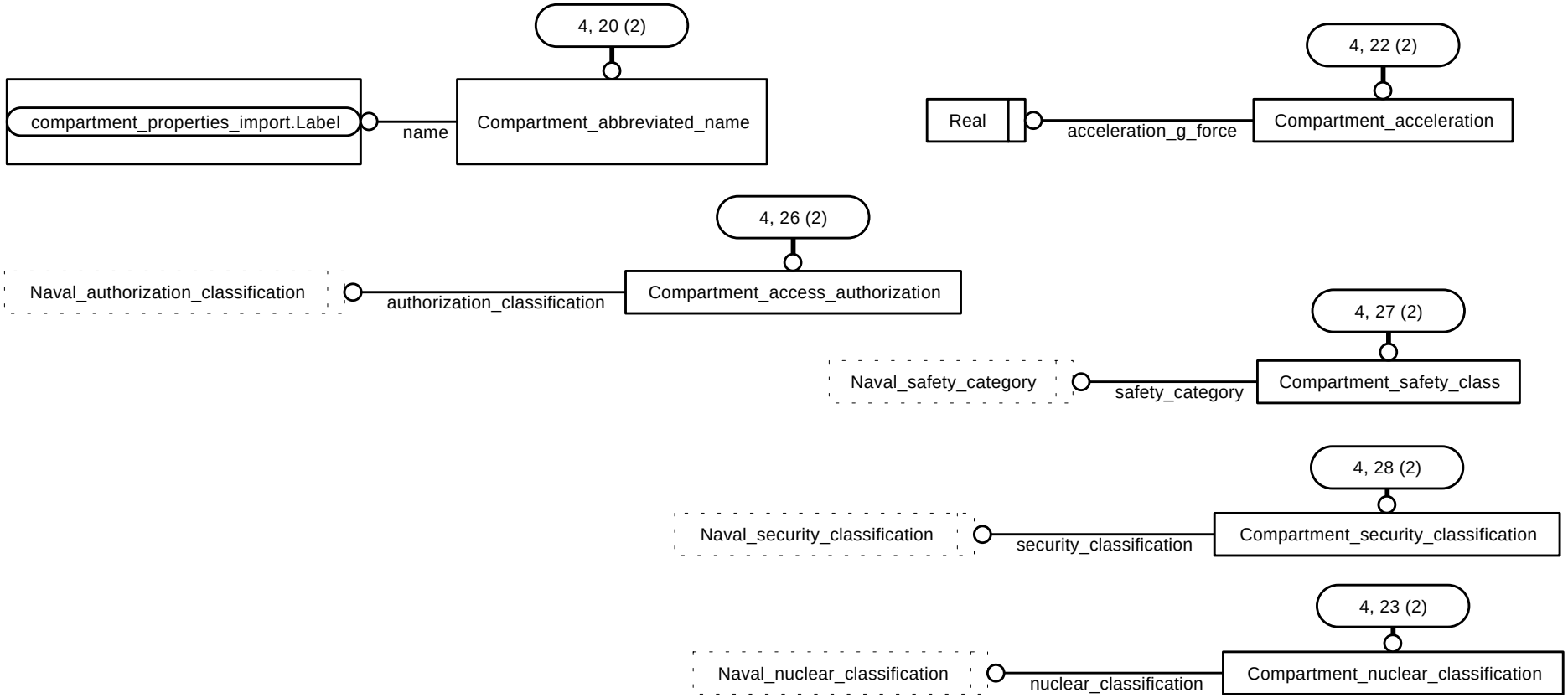

Figure G.24 - ARM diagram - compartment_properties UoF (figure 9 of 11)

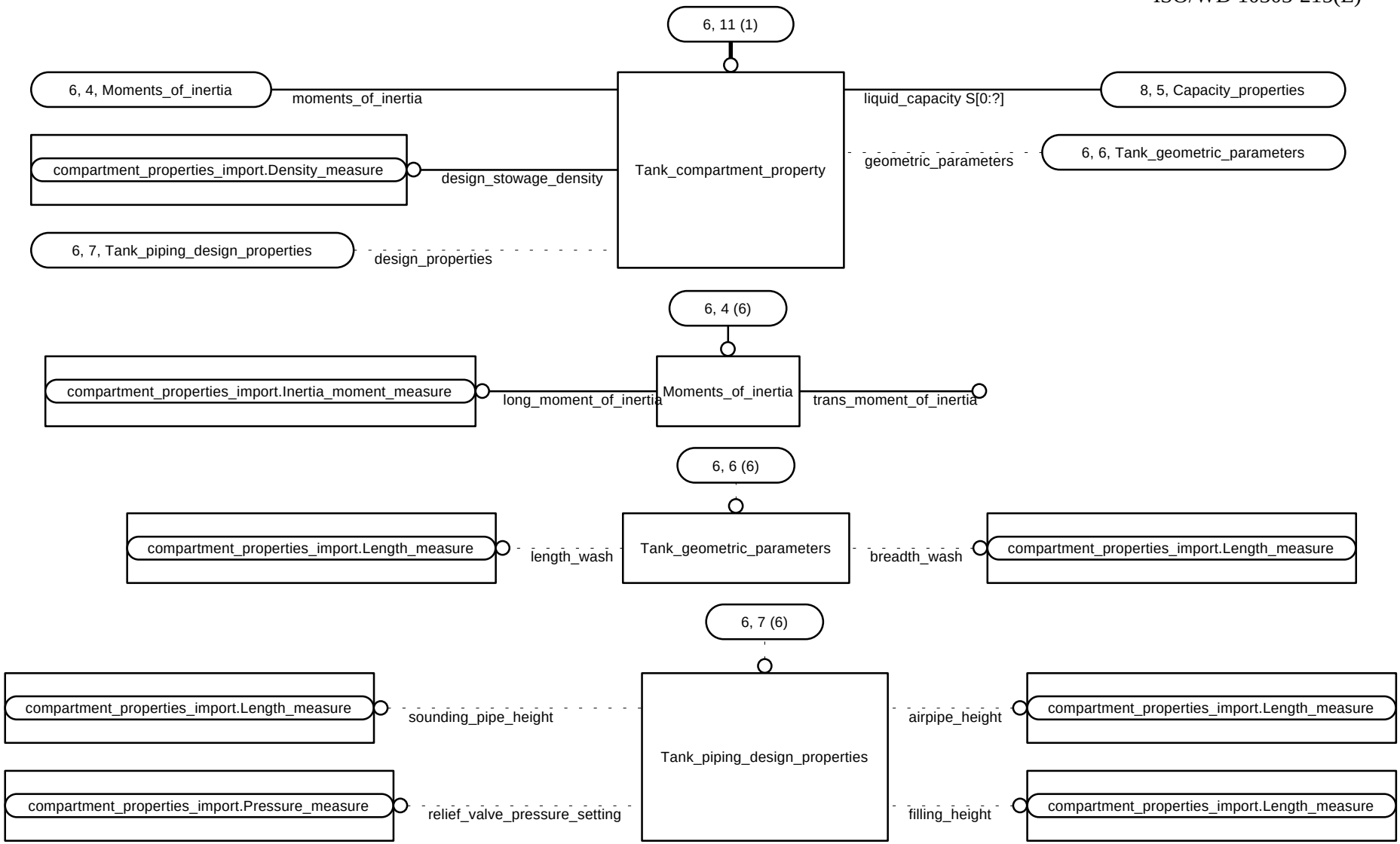

Figure G.25 - ARM diagram - compartment_properties UoF (figure 10 of 11)

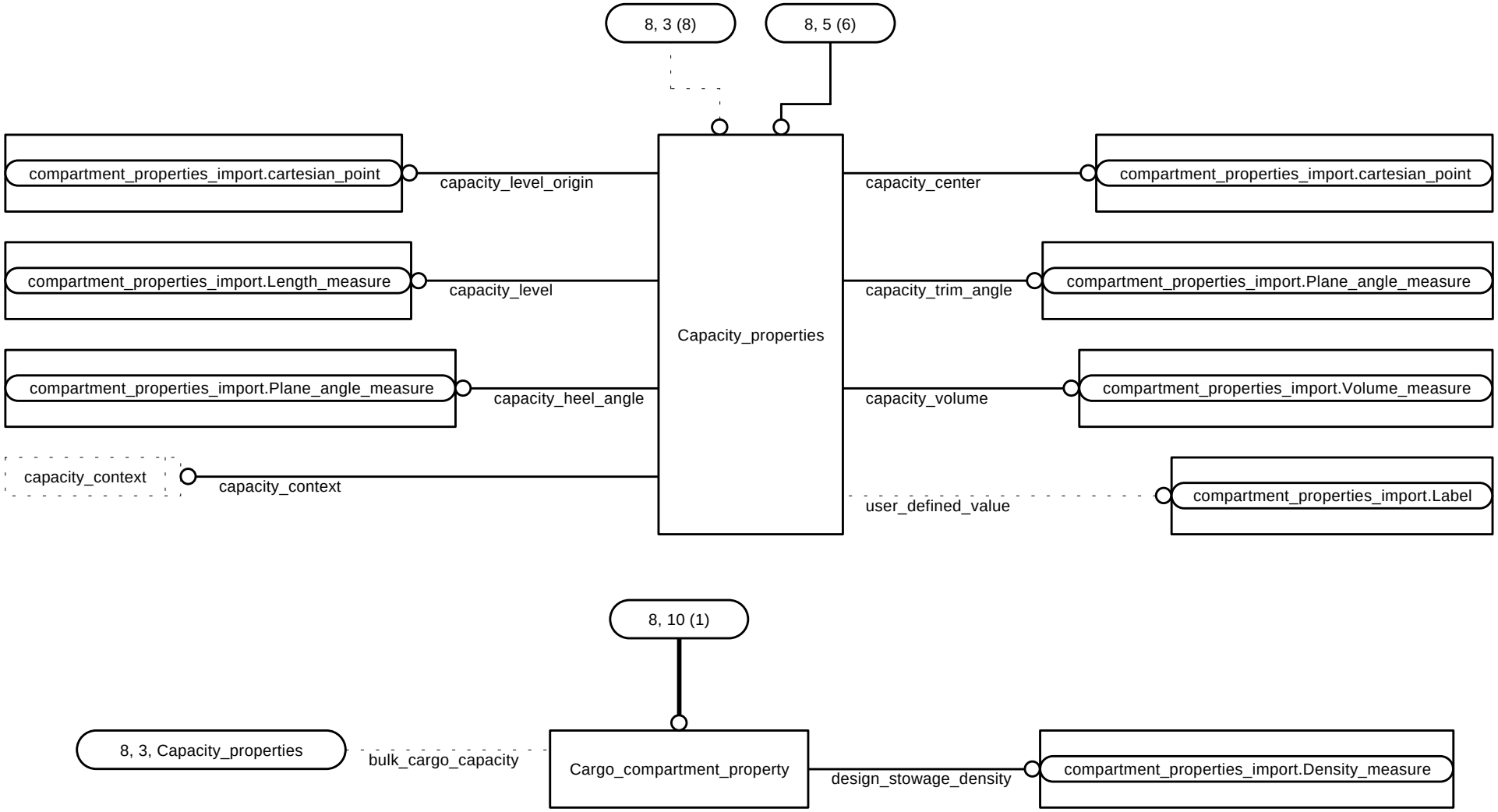

Figure G.26 - ARM diagram - compartment_properties UoF (figure 11 of 11)

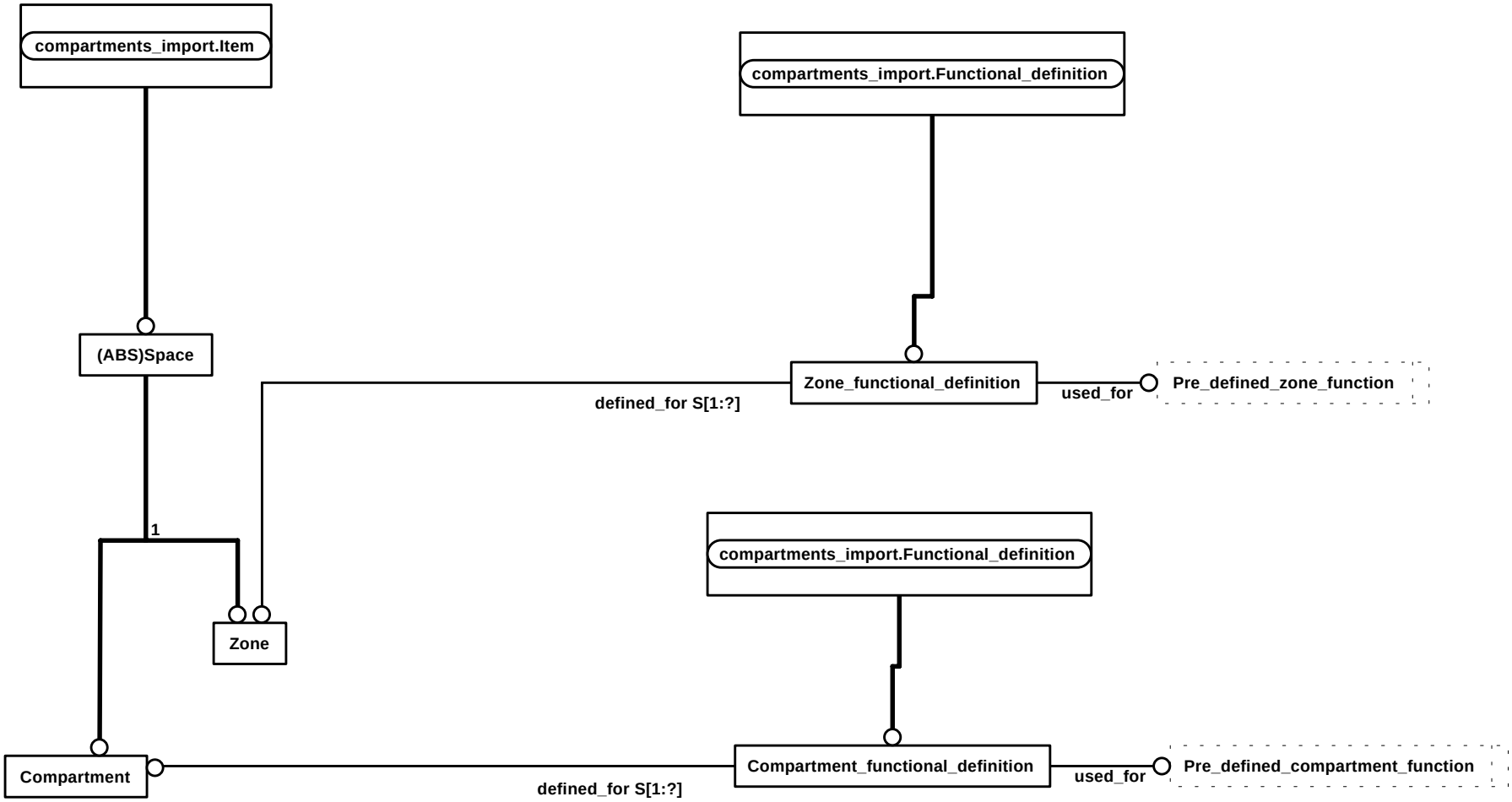

Figure G.27 - ARM diagram - compartments UoF (figure 1 of 1)

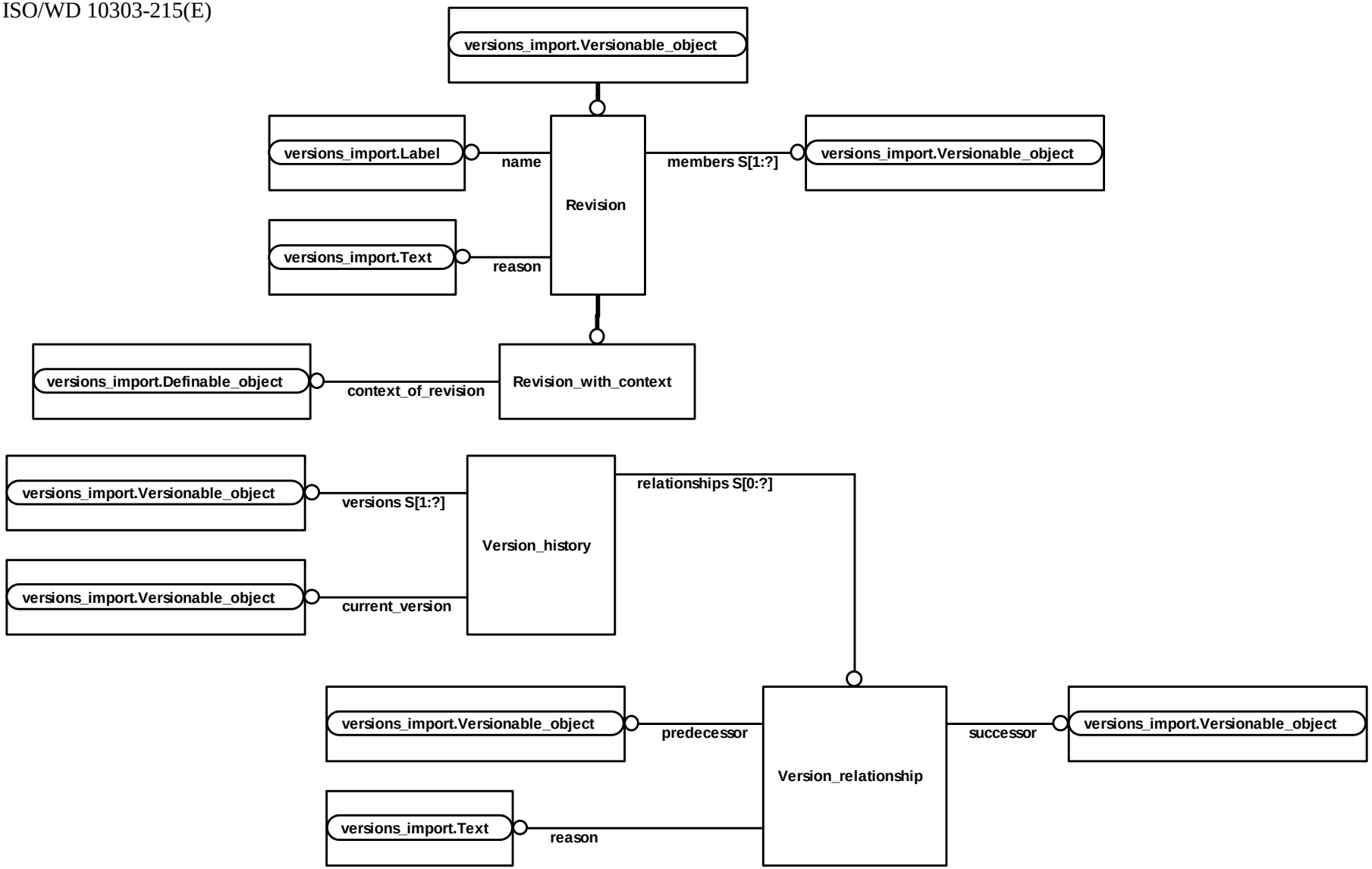

Figure G.28 - ARM diagram - configuration_management UoF (figure 1 of 5)

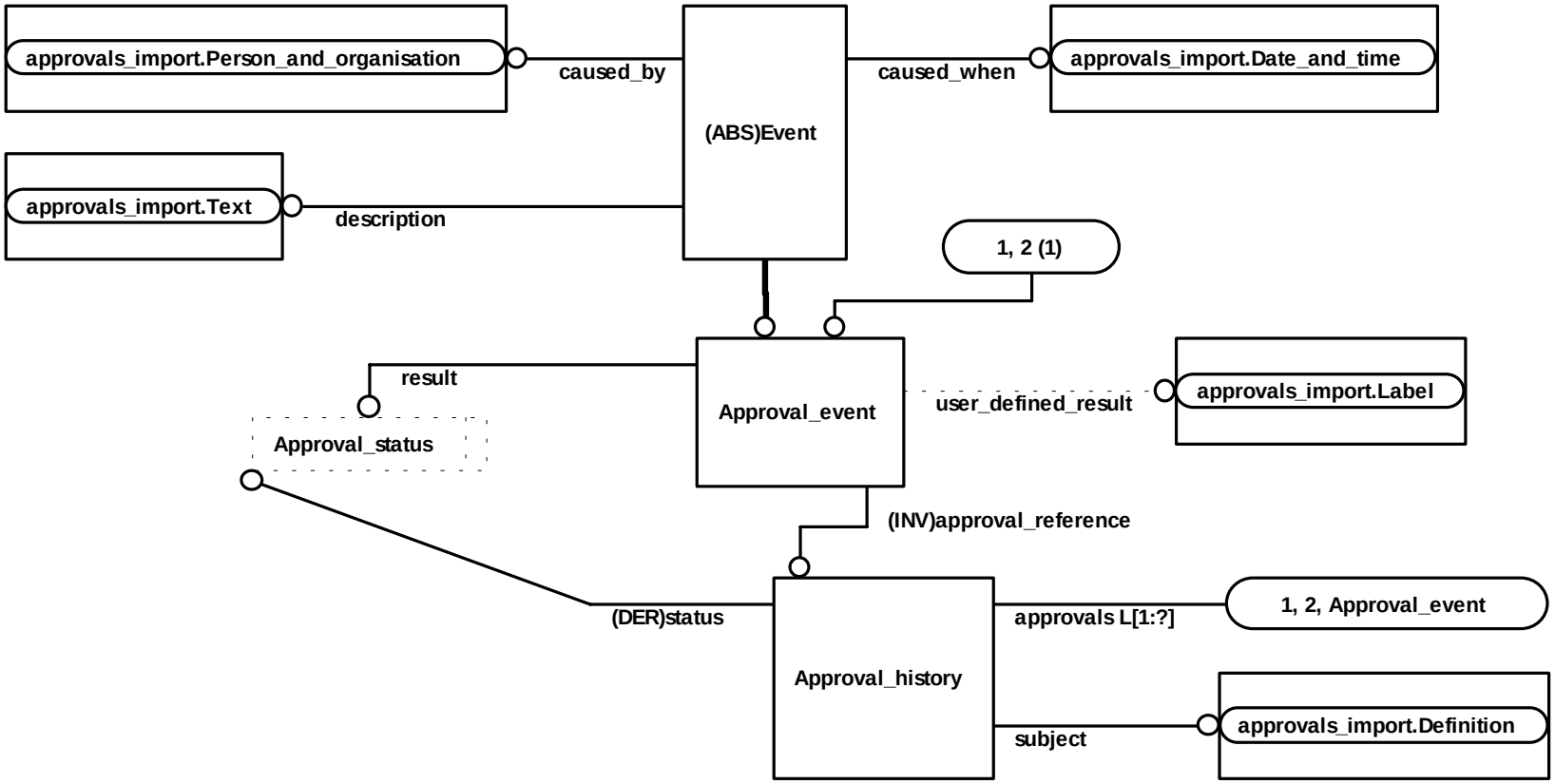

Figure G.29 - ARM diagram - configuration_management UoF (figure 2 of 5)

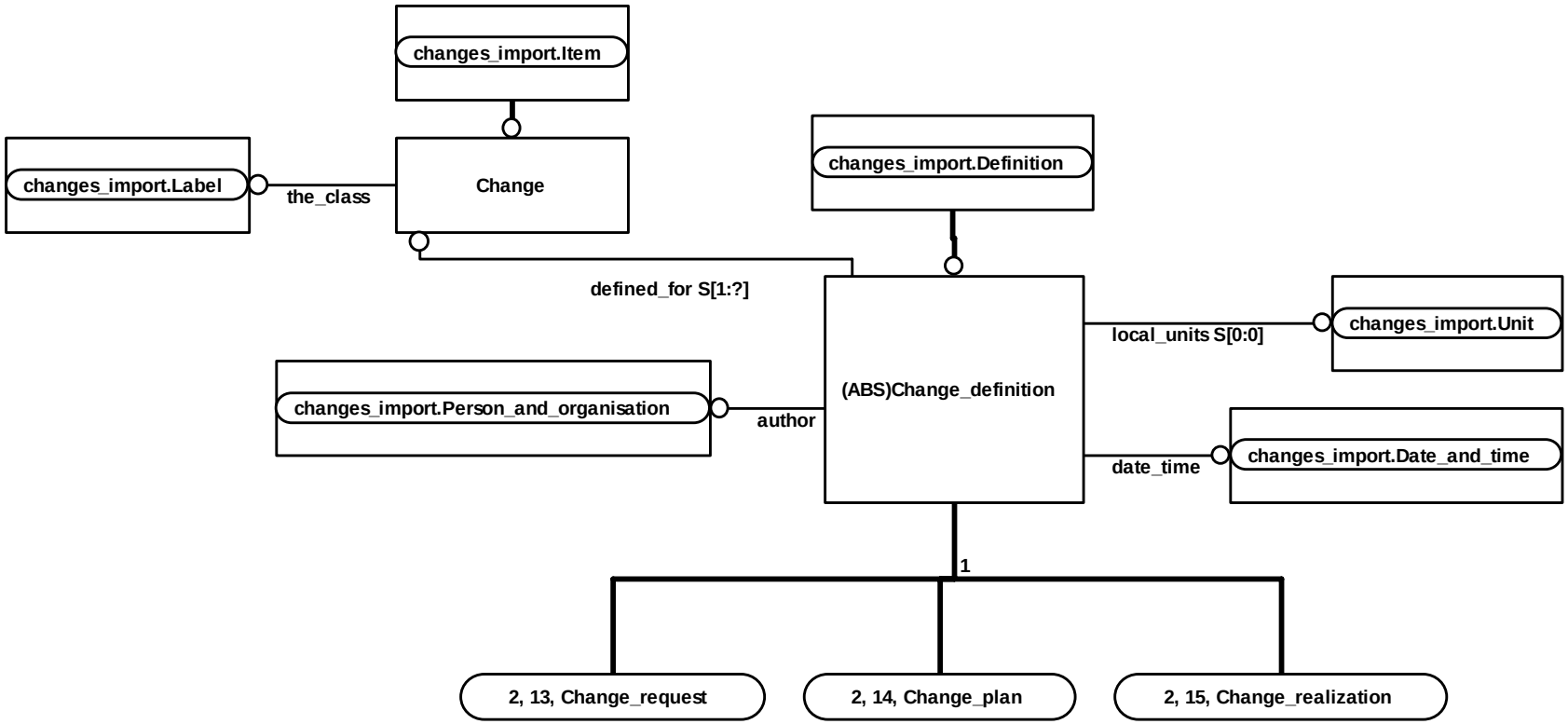

Figure G.30 - ARM diagram - configuration_management UoF (figure 3 of 5)

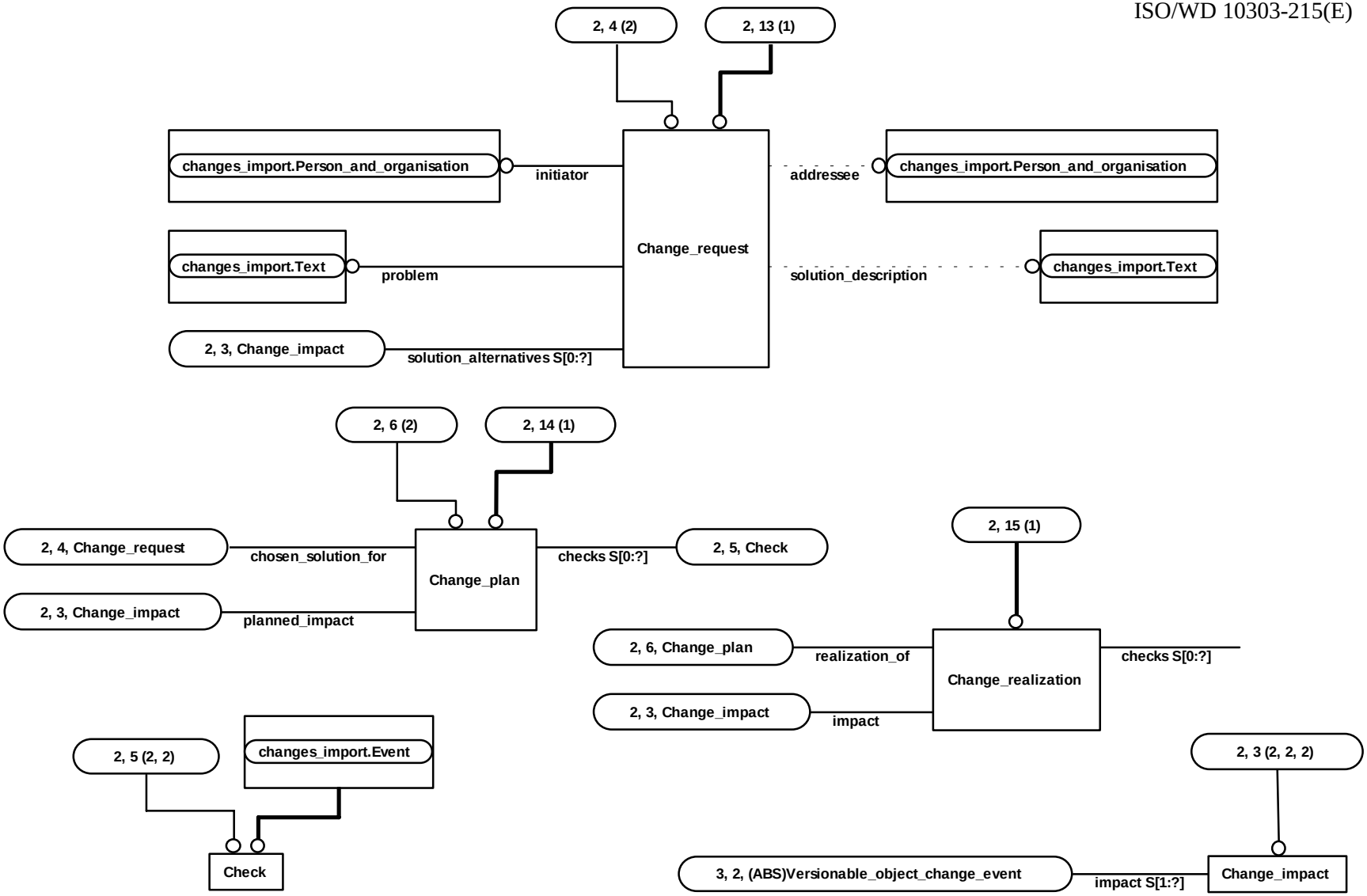

Figure G.31 - ARM diagram - configuration_management UoF (figure 4 of 5)

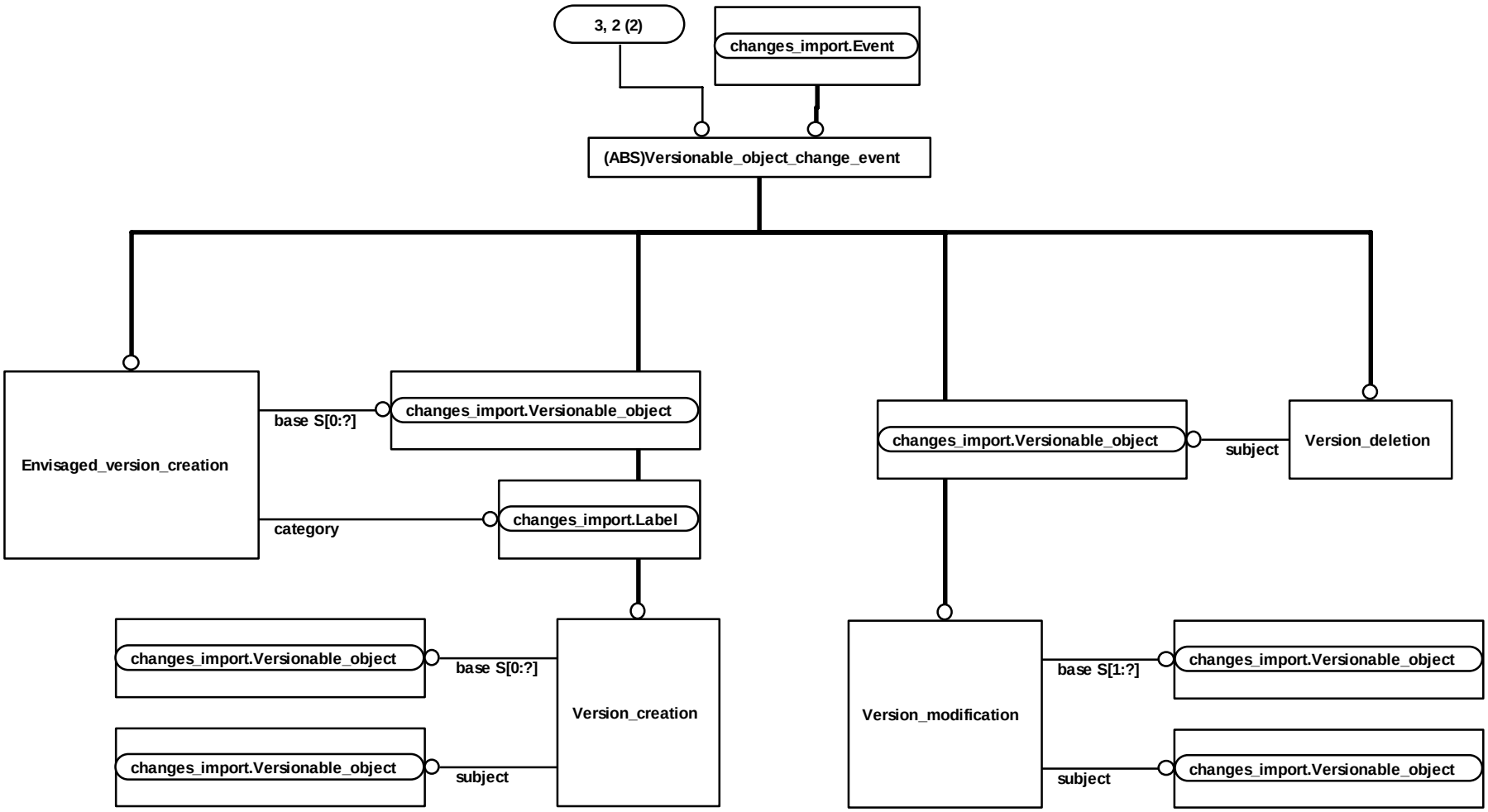

Figure G.32 - ARM diagram - configuration_management UoF (figure 5 of 5)

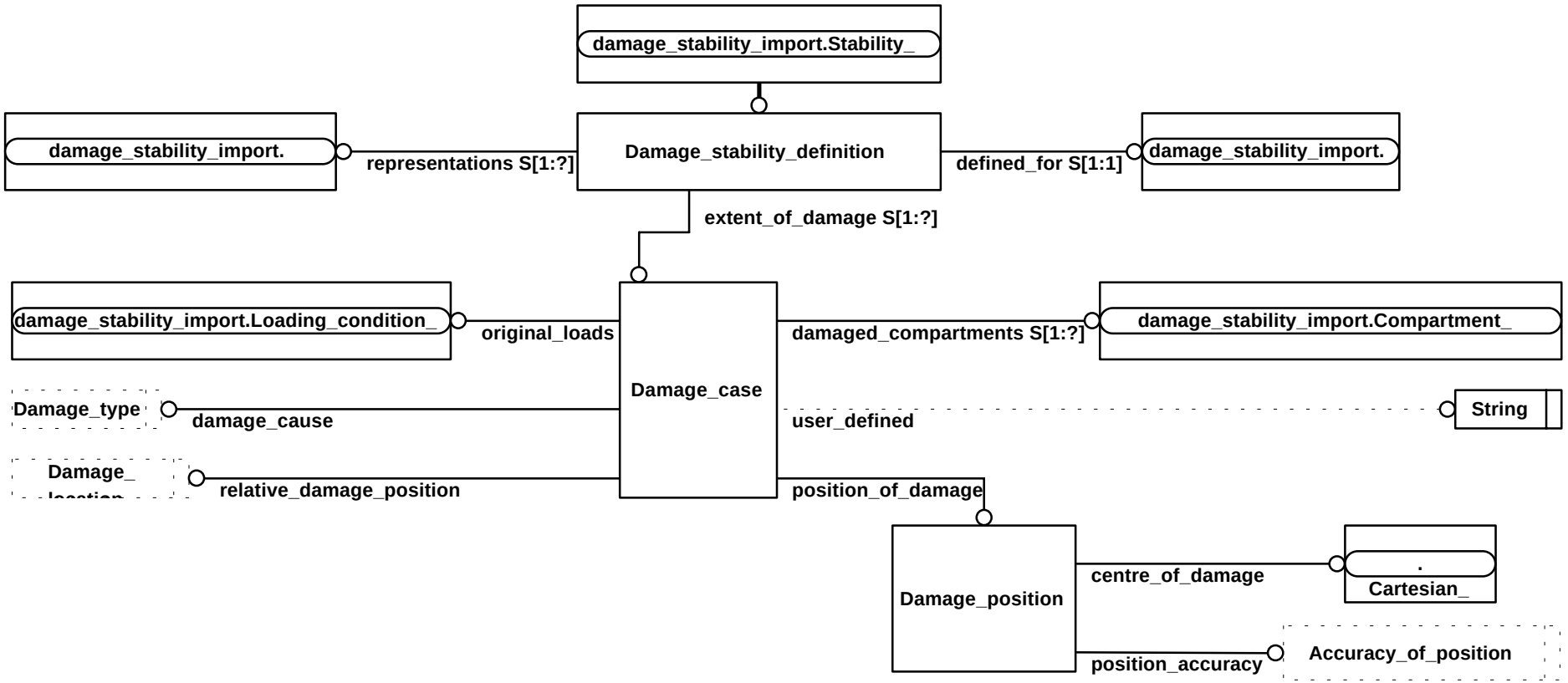

Figure G.33 - ARM diagram - damaged_stability UoF (figure 1 of 1)

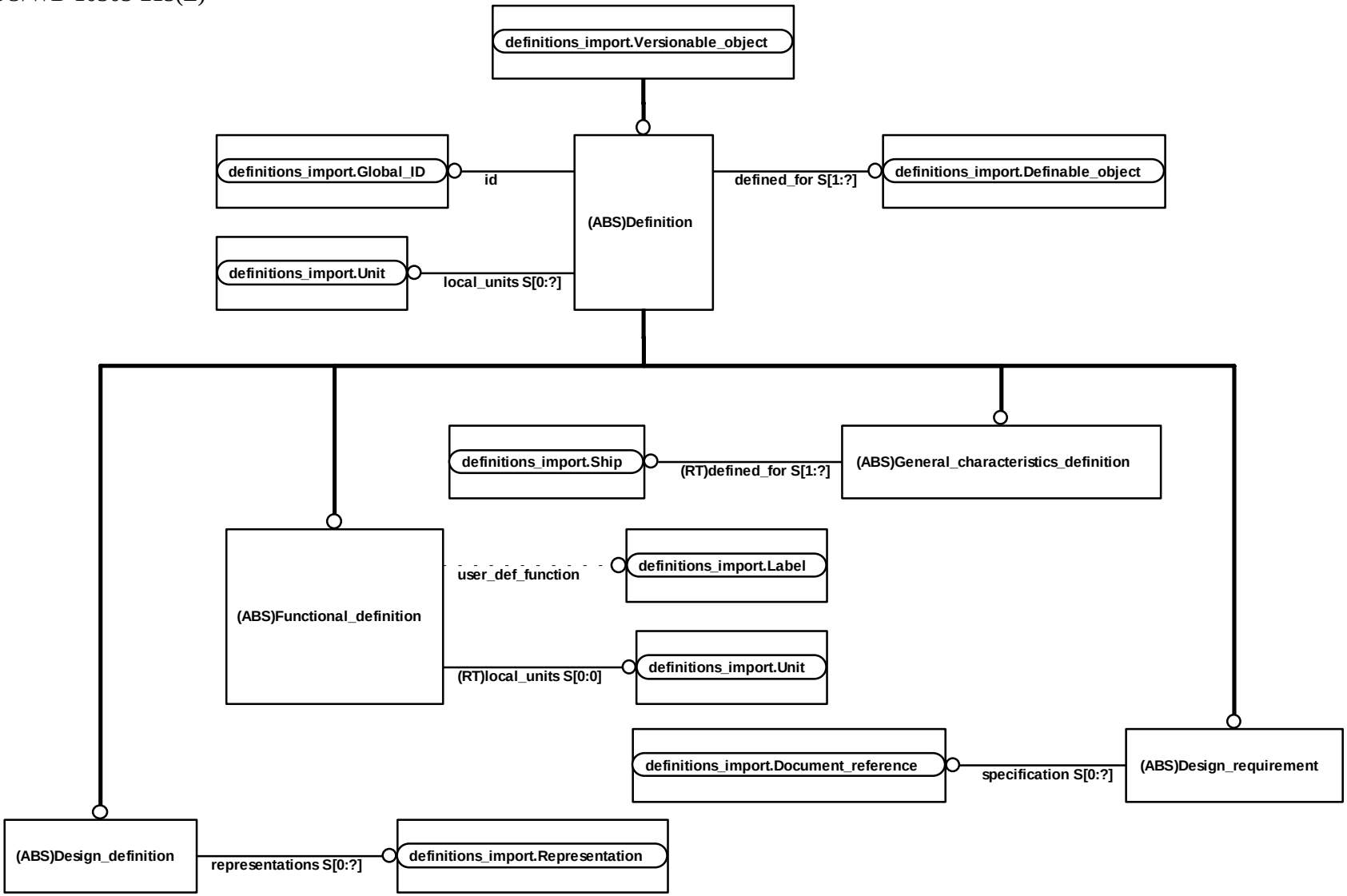

Figure G.34 - ARM diagram - definitions UoF (figure 1 of 1)

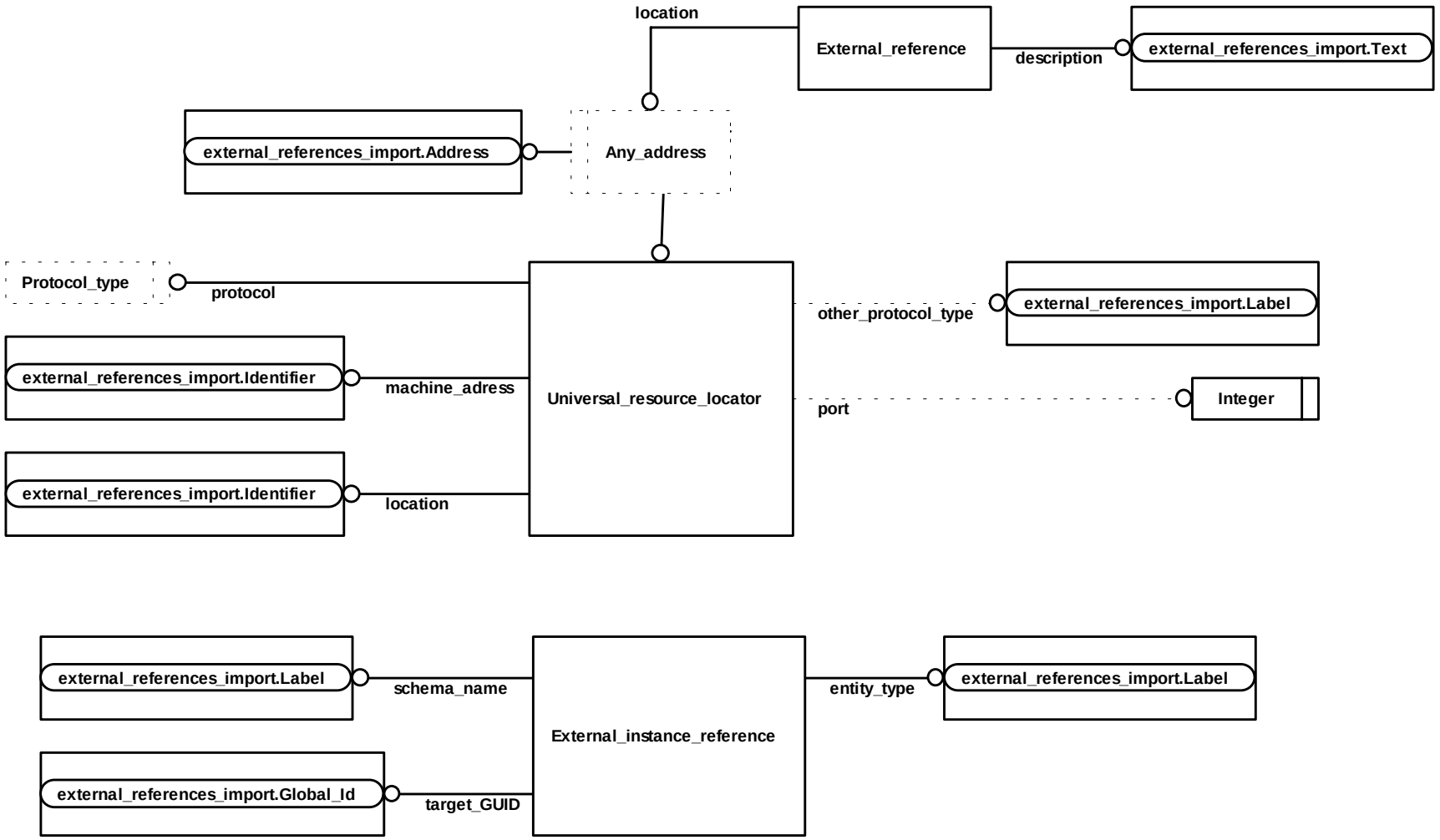

Figure G.35 - ARM diagram - external_references UoF (figure 1 of 2)

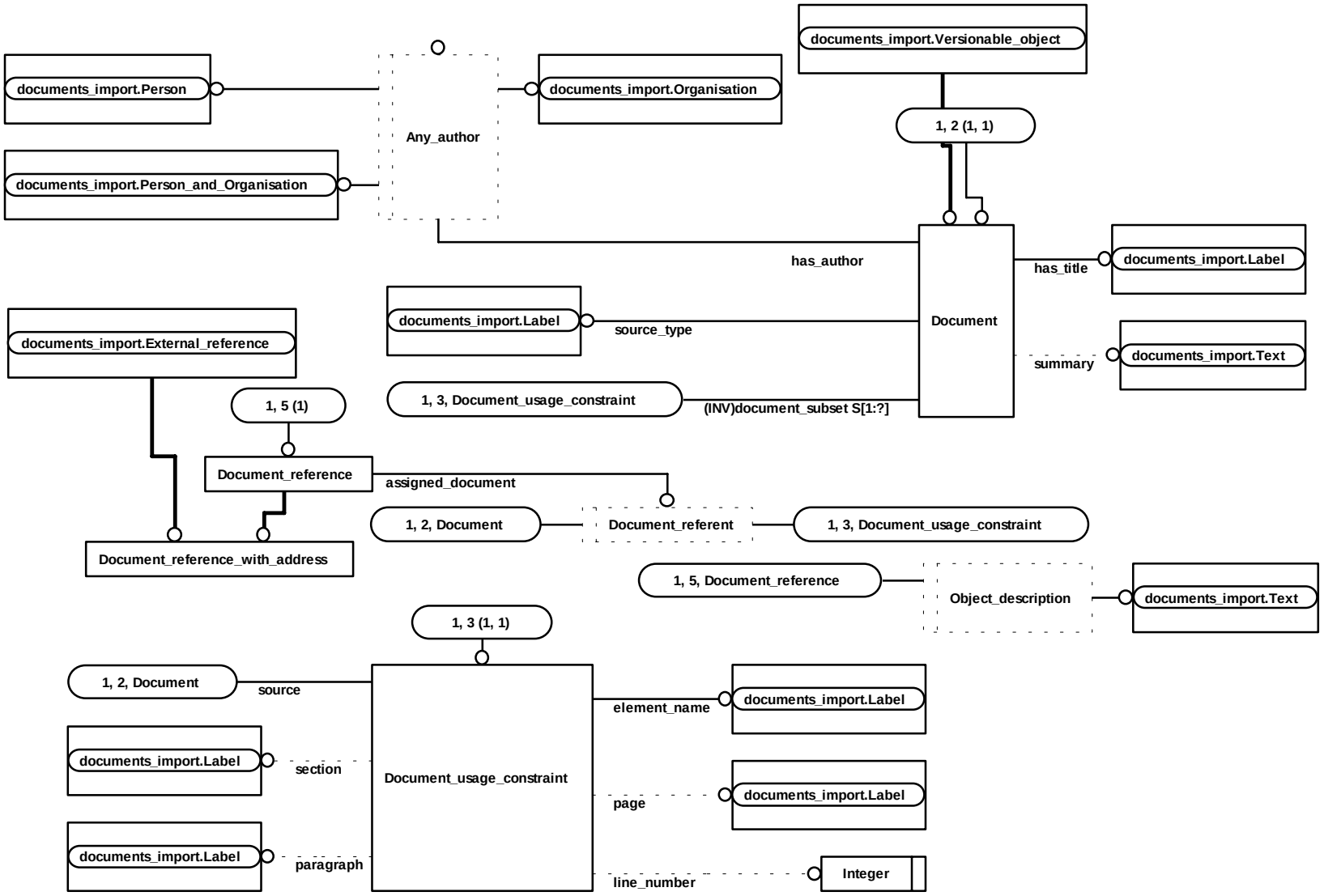

Figure G.36 - ARM diagram - external_references UoF (figure 2 of 2)

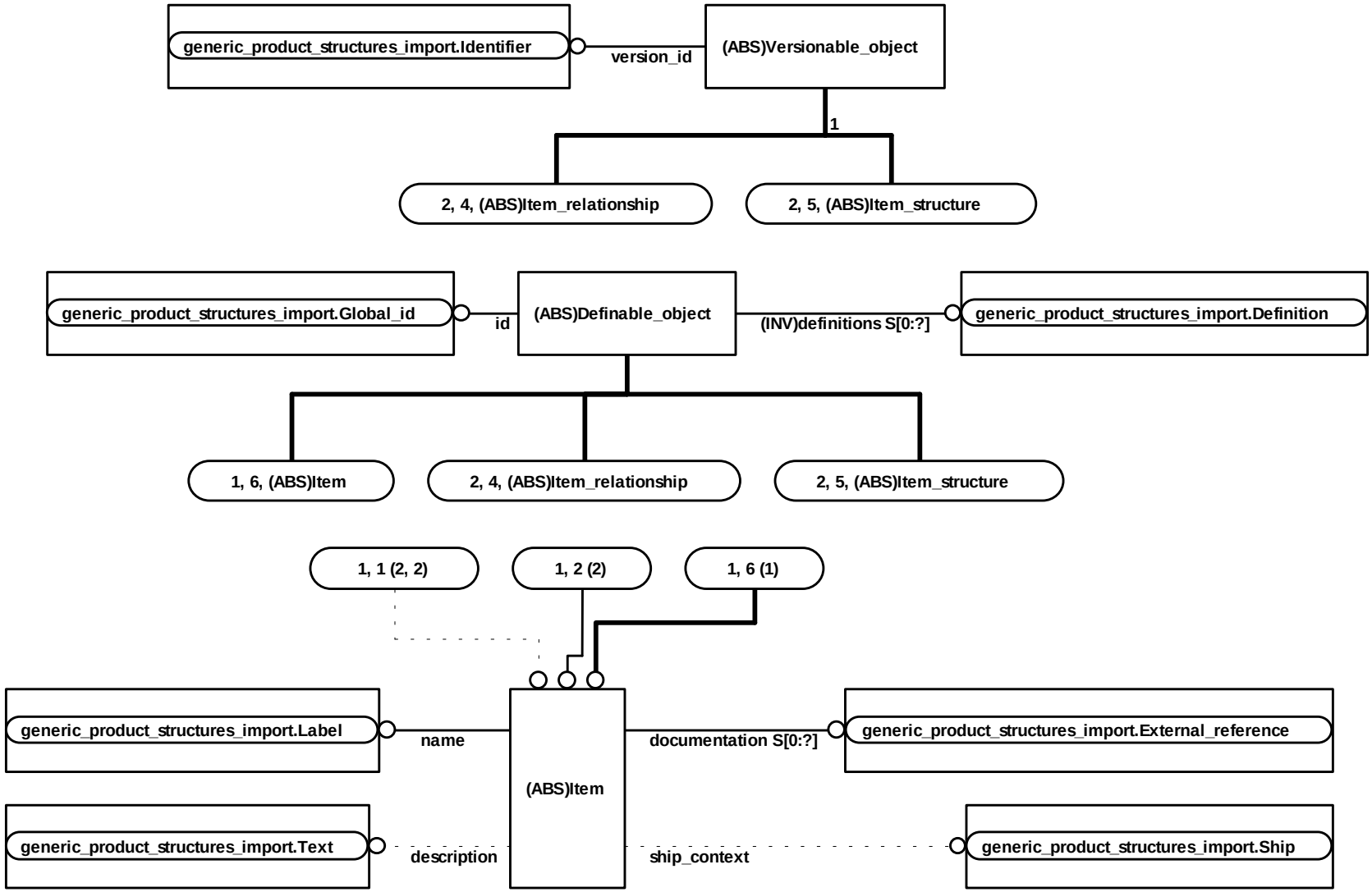

Figure G.37 - ARM diagram - items UoF (figure 1 of 3)

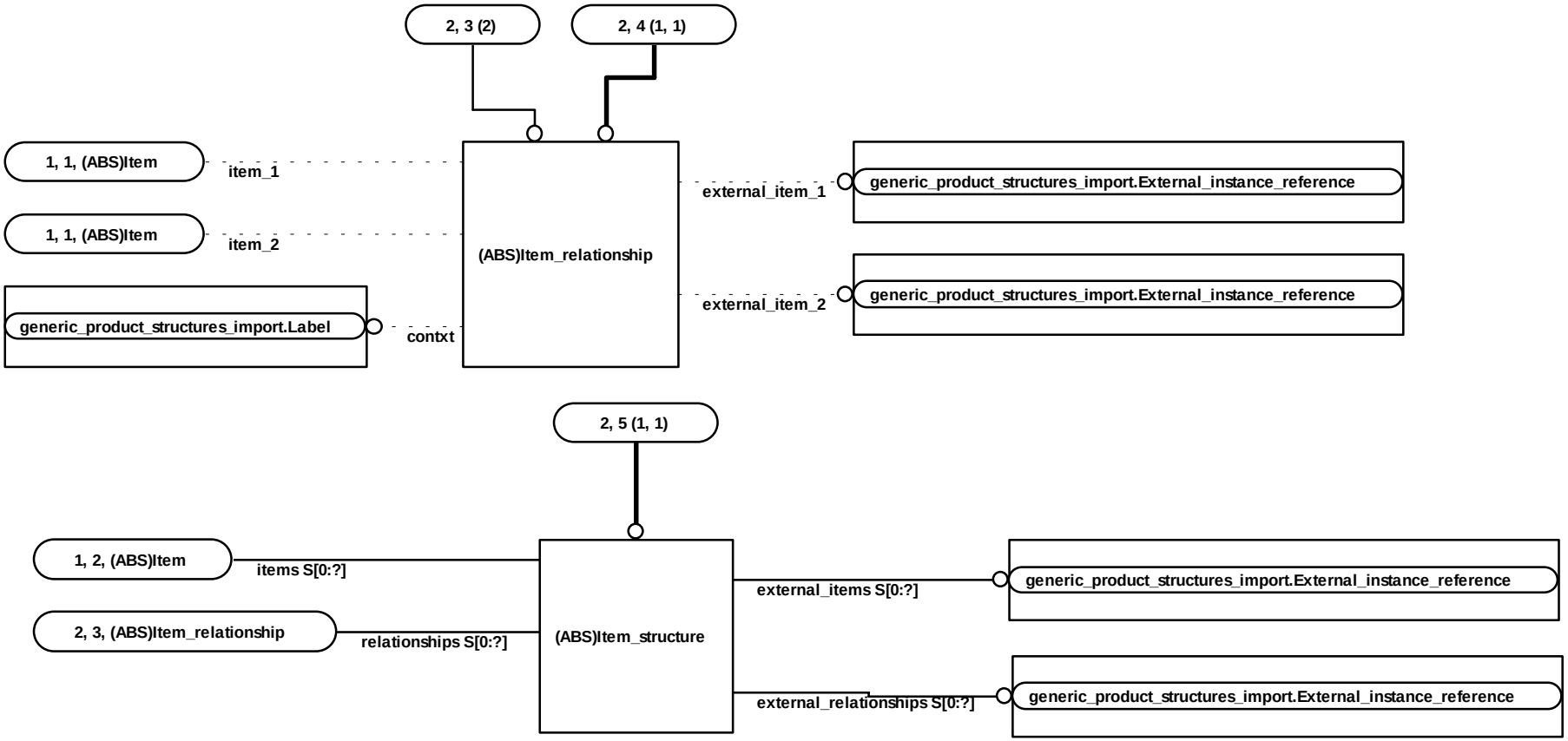

Figure G.38 - ARM diagram - items UoF (figure 2 of 3)

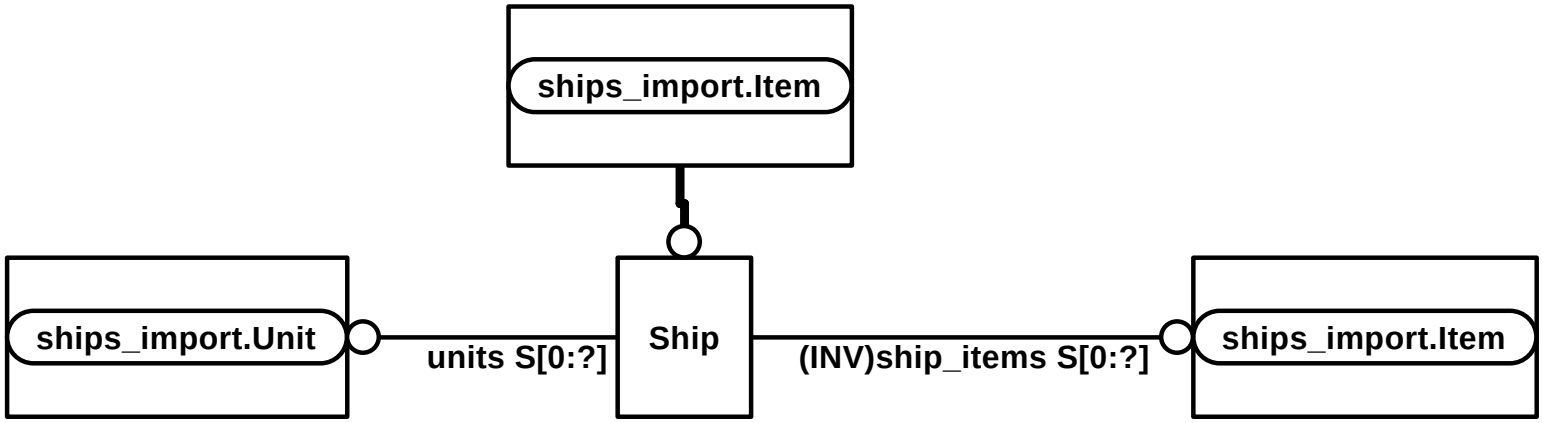

Figure G.39 - ARM diagram - items UoF (figure 3 of 3)

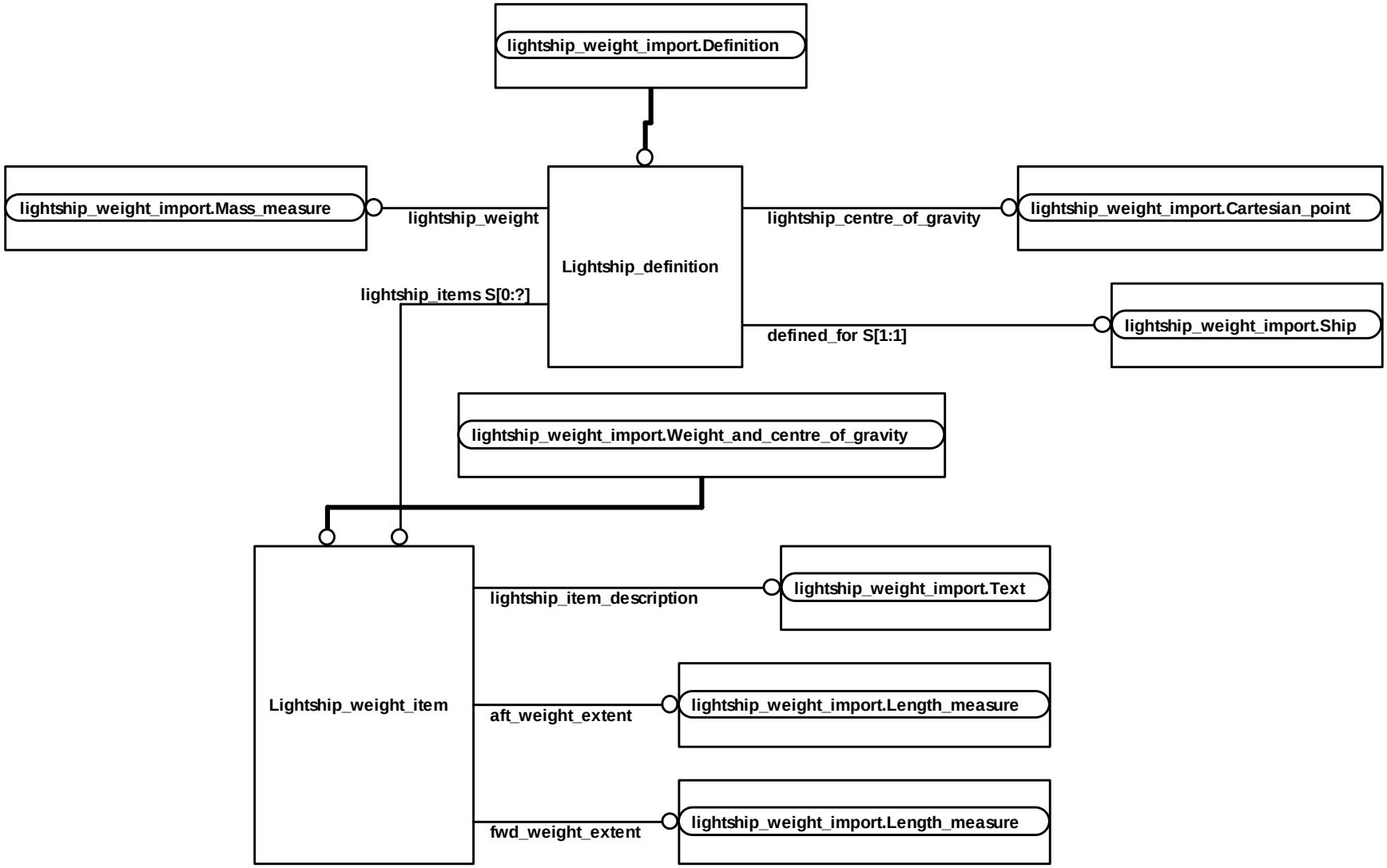

Figure G.40 - ARM diagram - lightship_weight UoF (figure 1 of 1)

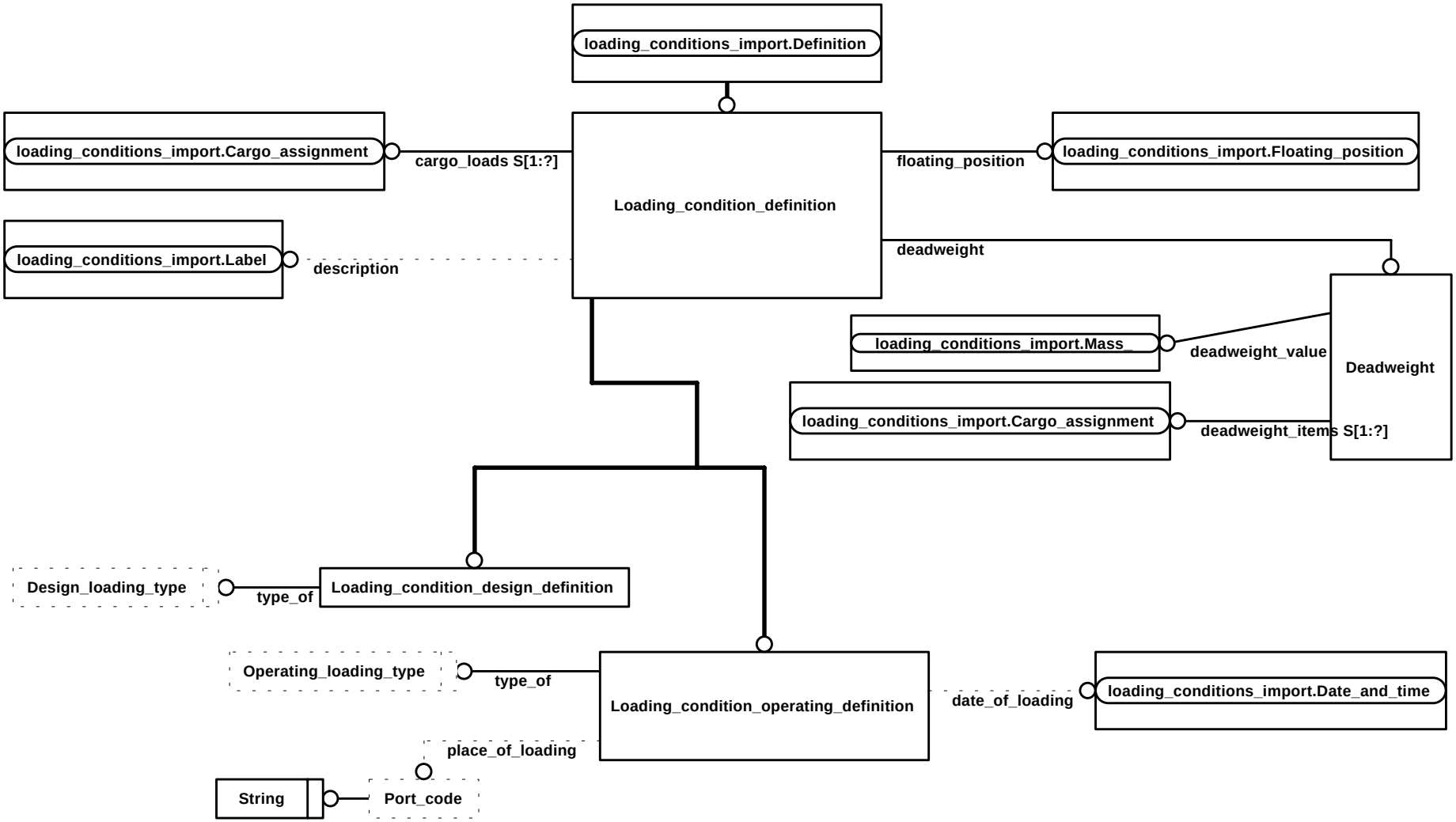

Figure G.41 - ARM diagram - loading_conditions UoF (figure 1 of 1)

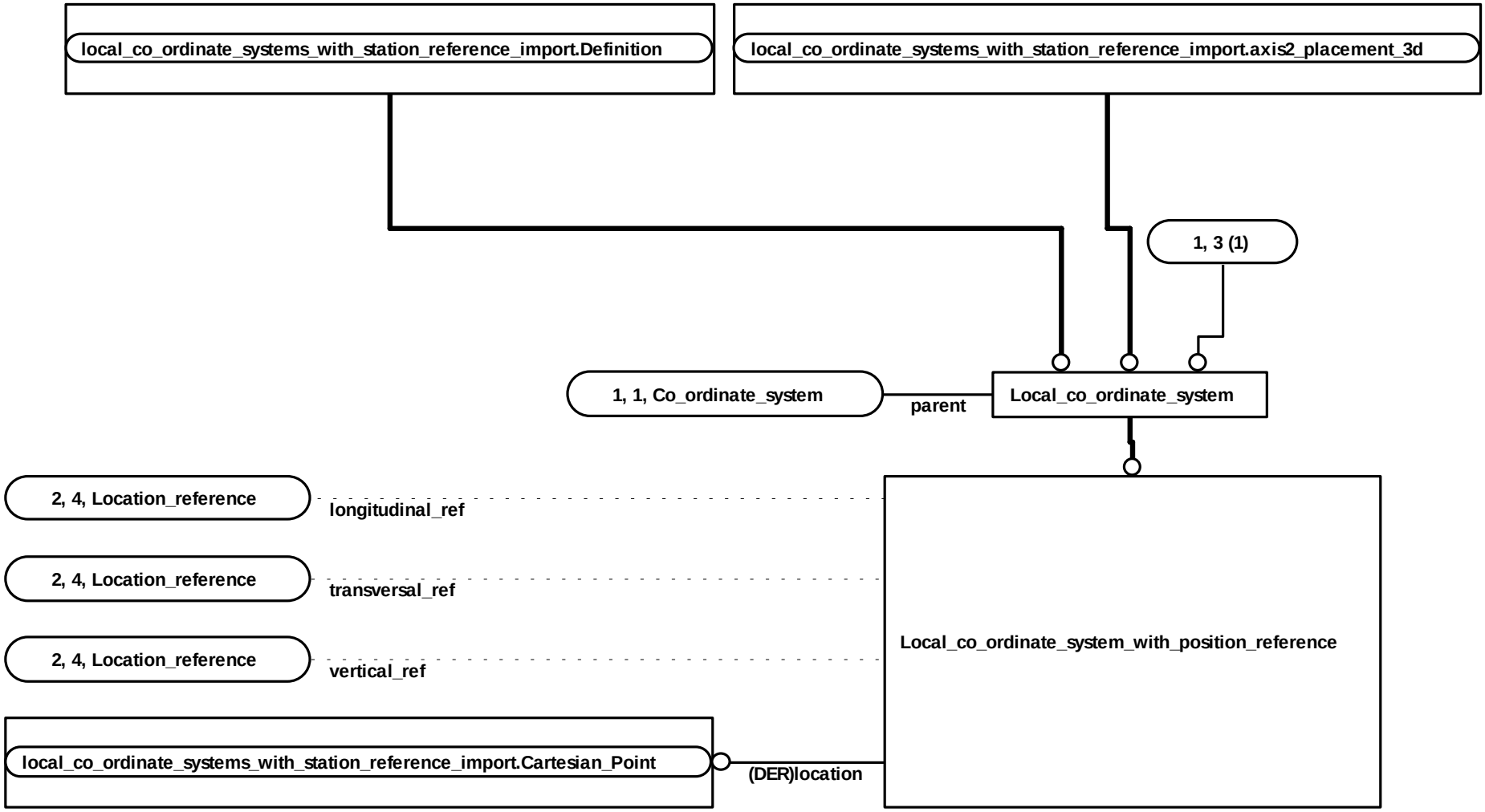

Figure G.42 - ARM diagram - location_concepts UoF (figure 1 of 2)

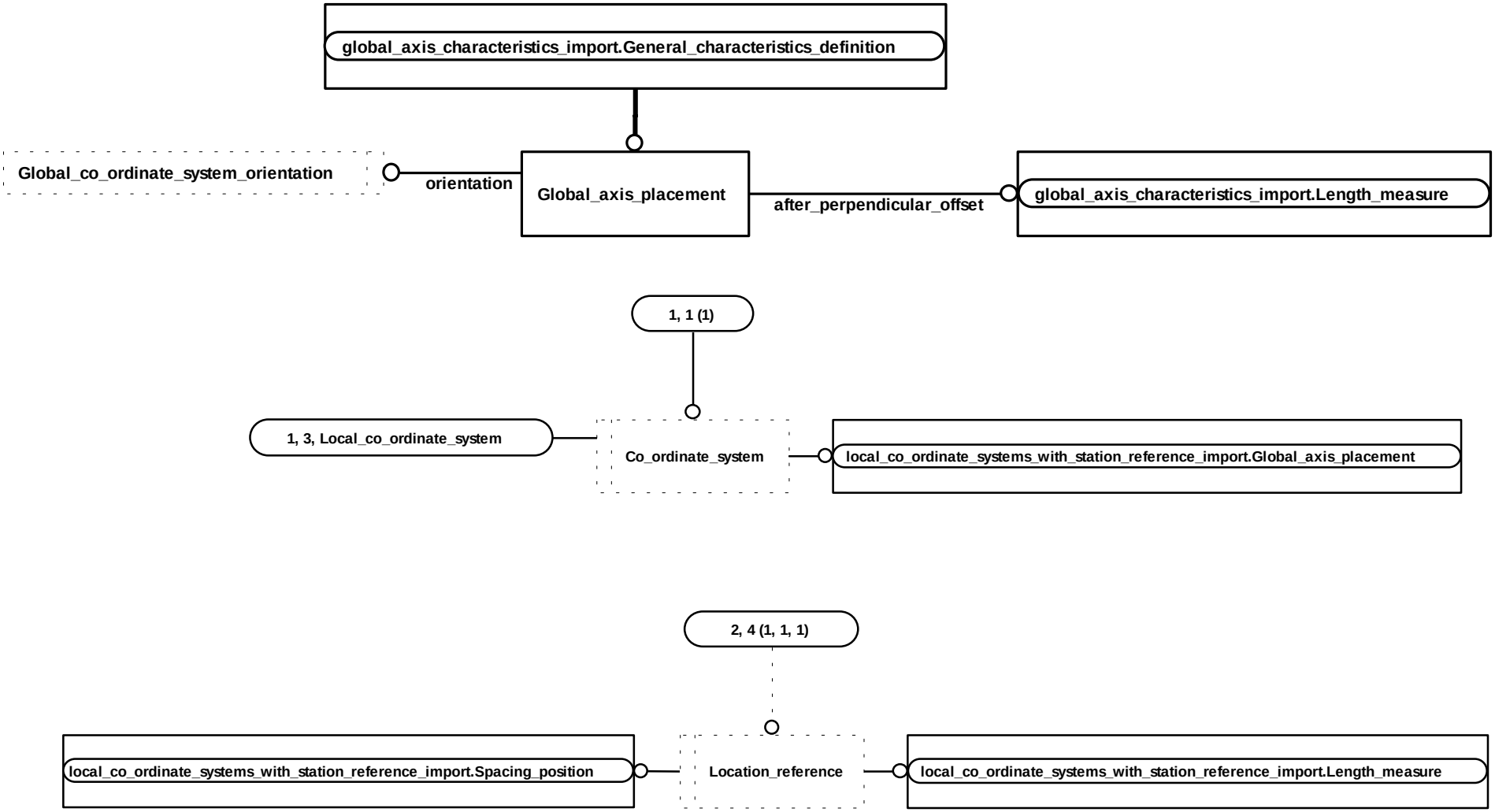

Figure G.43 - ARM diagram - location_concepts UoF (figure 2 of 2)

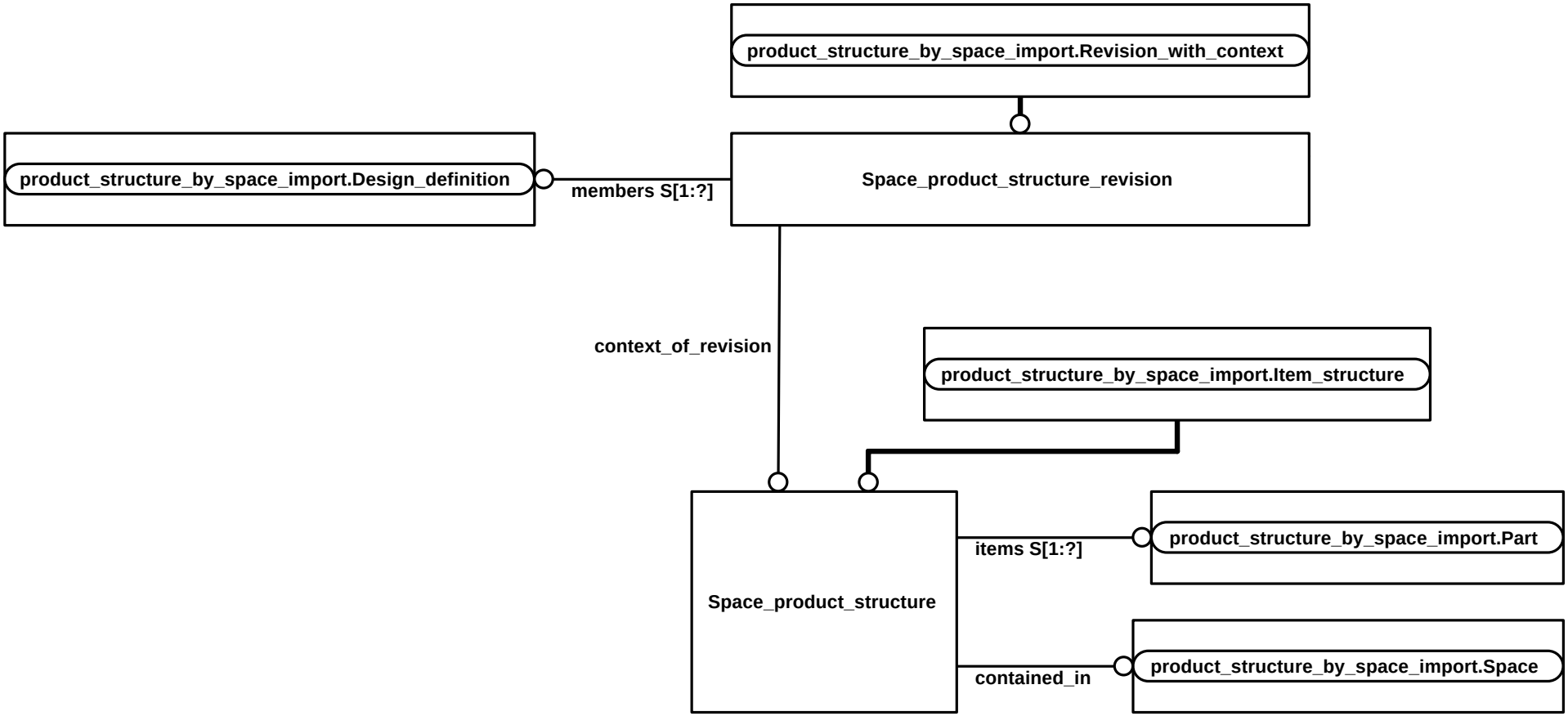

Figure G.44 - ARM diagram - product_structures UoF (figure 1 of 1)

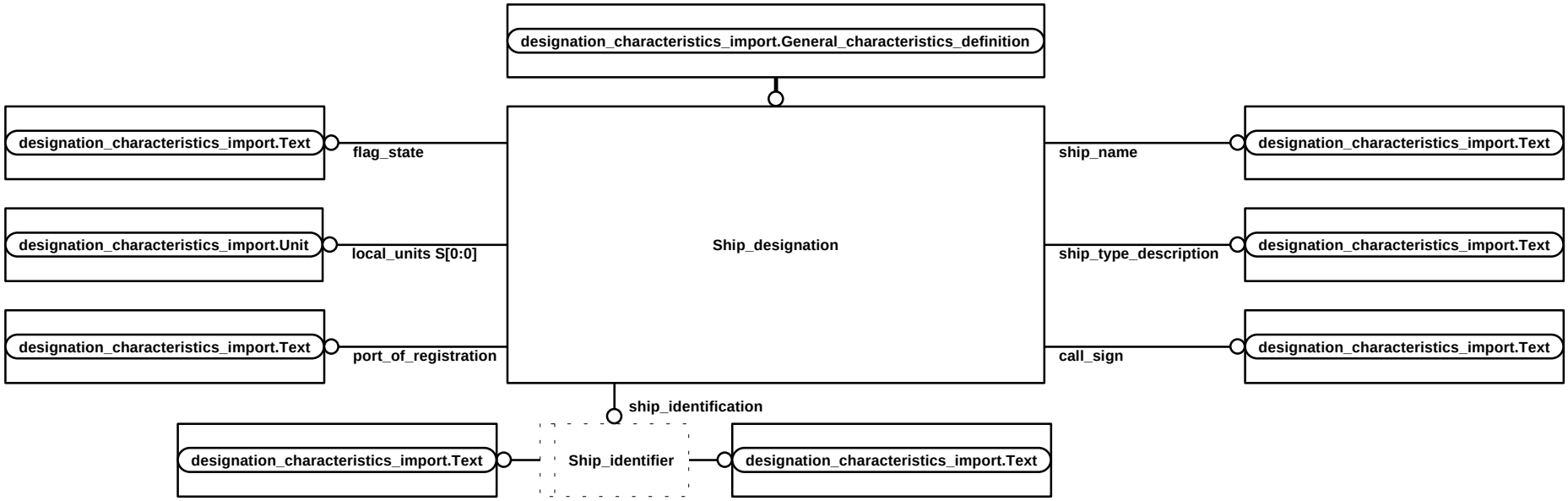

Figure G.45 - ARM diagram - ship_general_characteristics UoF (figure 1 of 3)

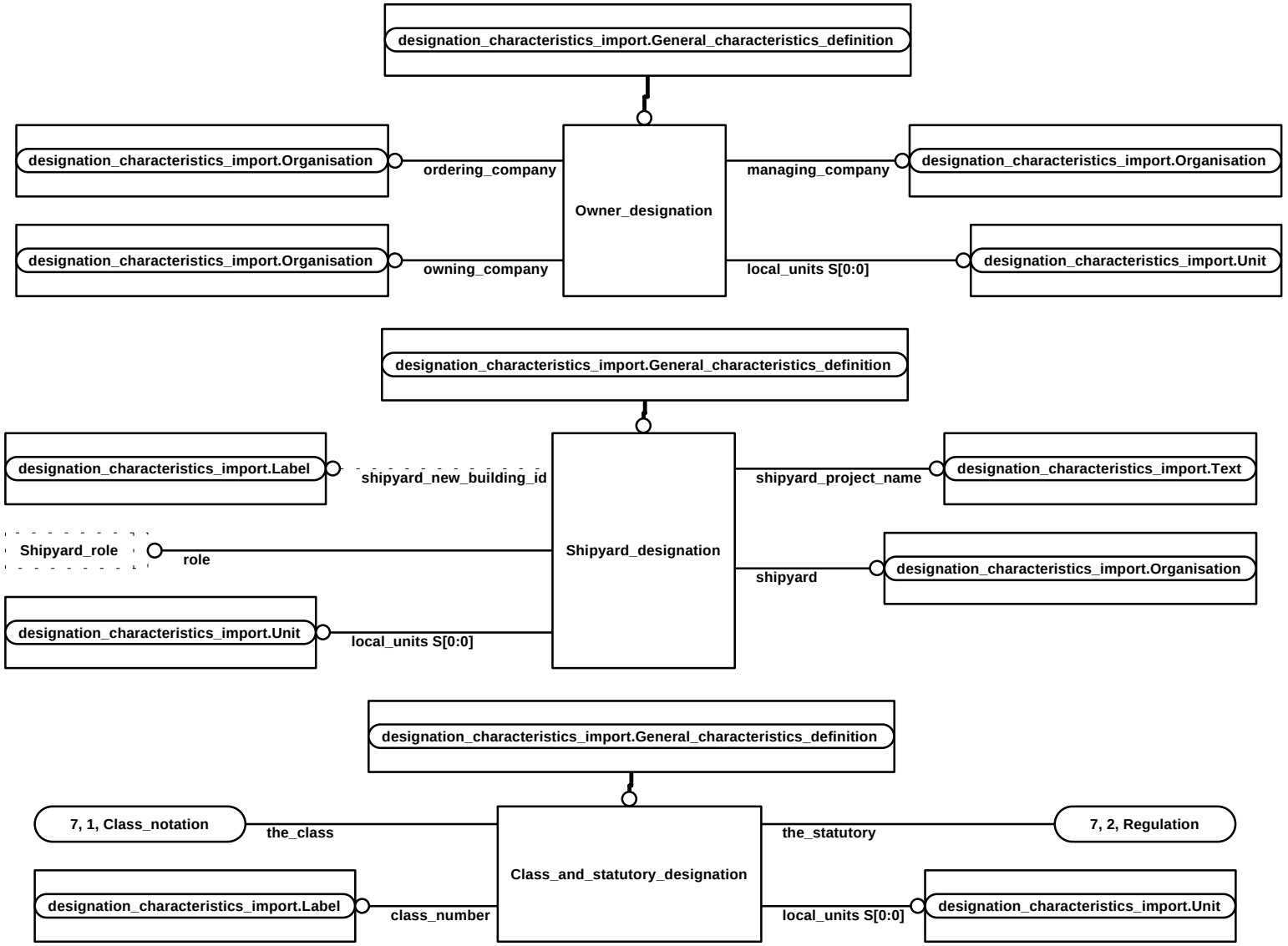

Figure G.46 - ARM diagram - ship_general_characteristics UoF (figure 2 of 3)

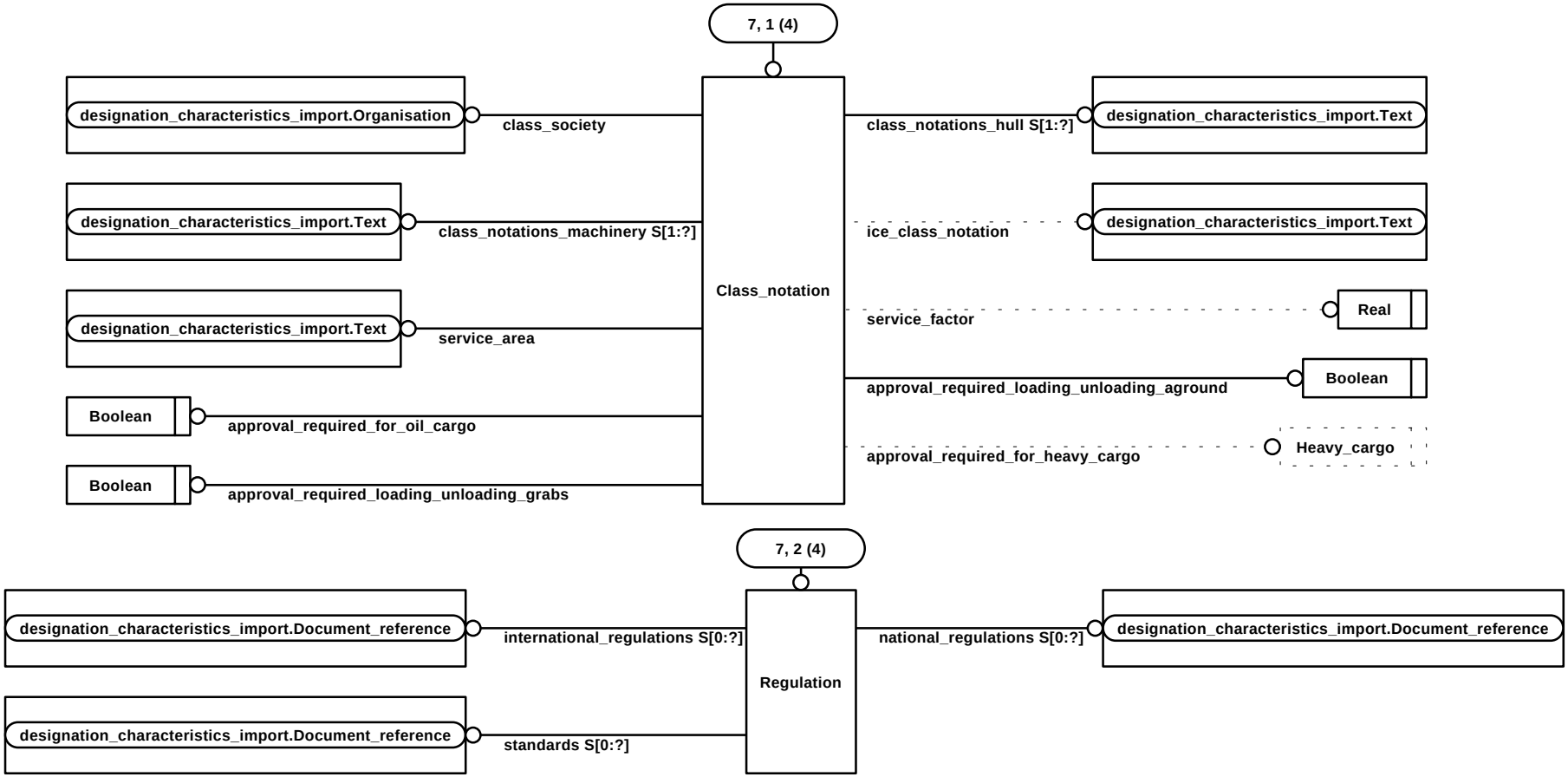

Figure G.47 - ARM diagram - ship_general_characteristics UoF (figure 3 of 3)

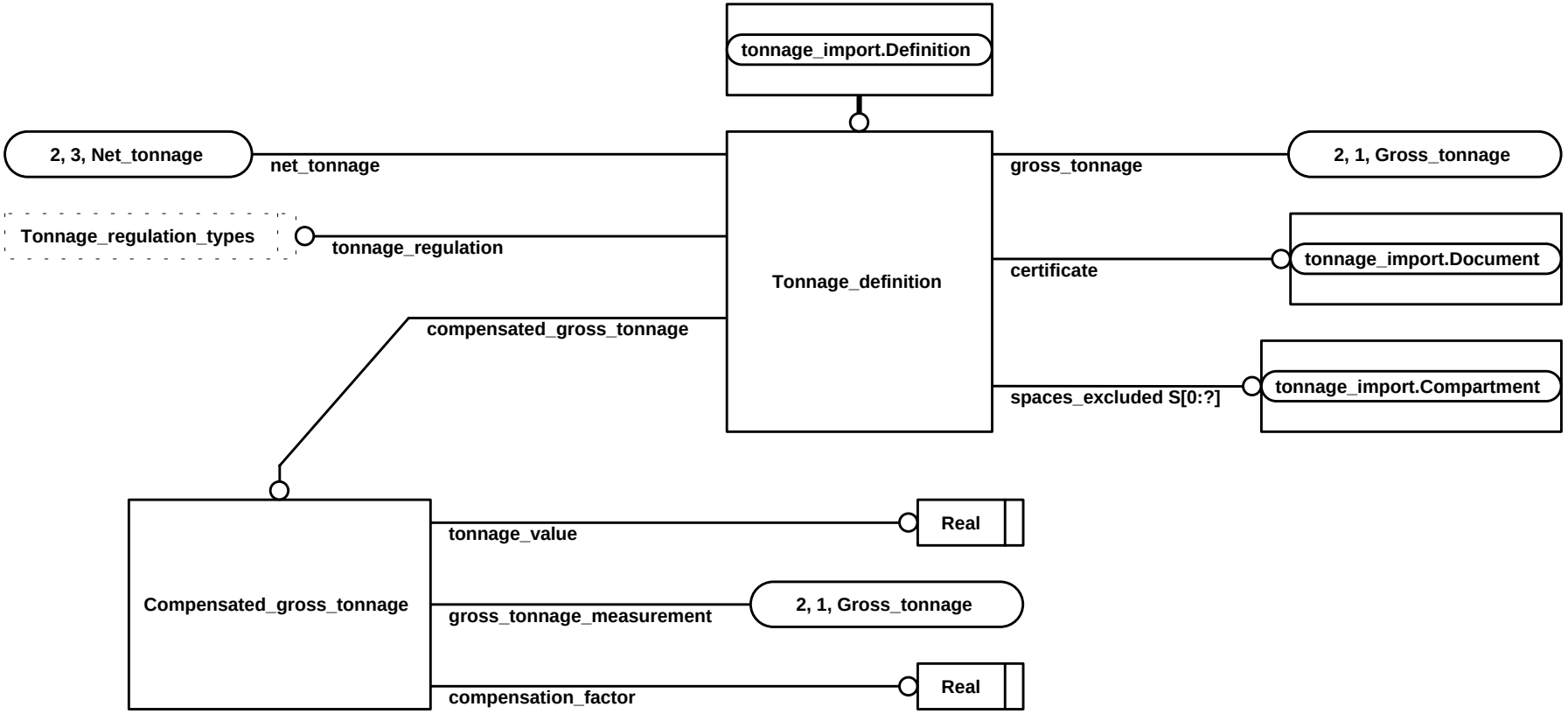

Figure G.48 - ARM diagram - tonnage UoF (figure 1 of 2)

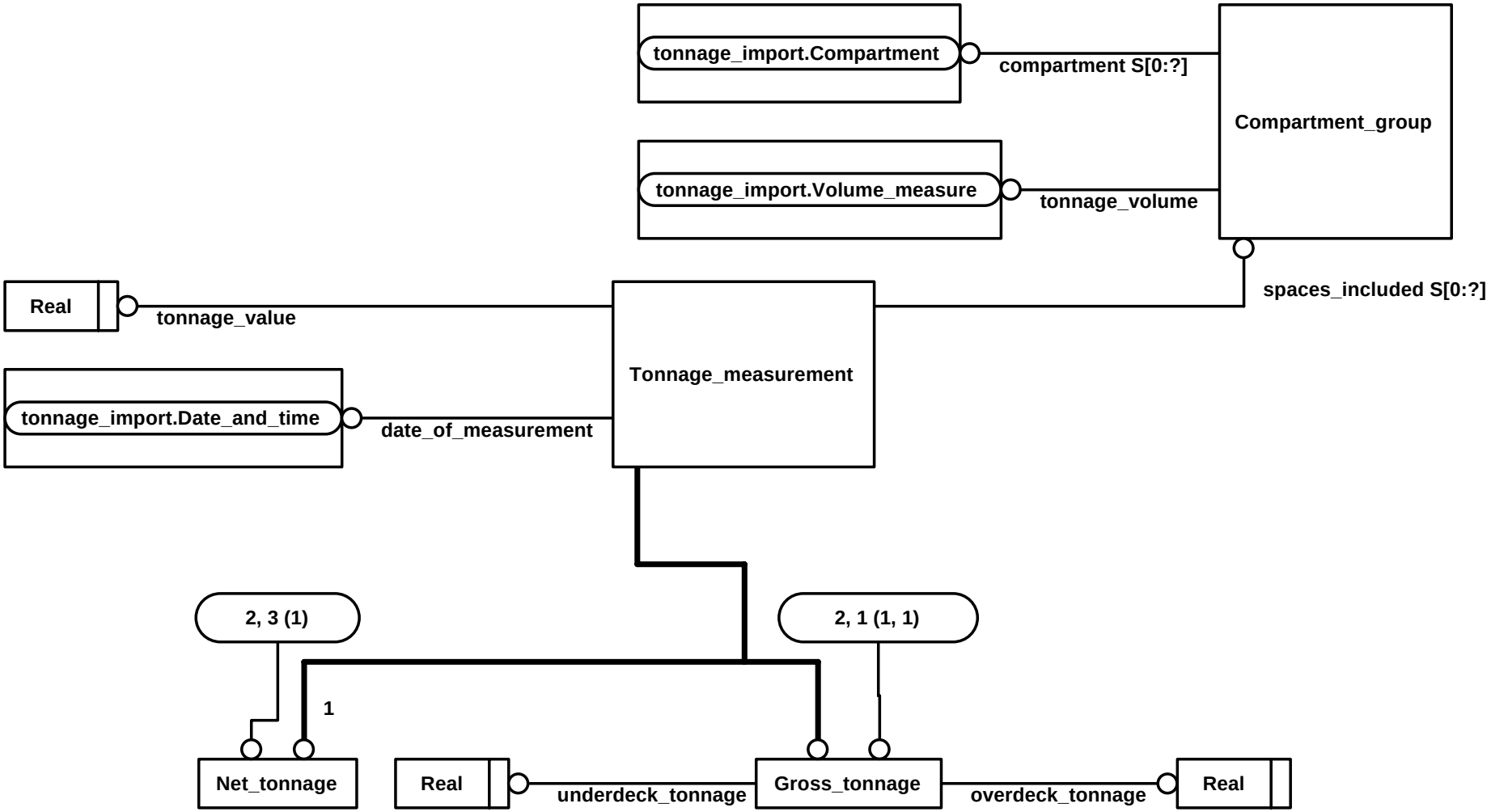

Figure G.49 - ARM diagram - tonnage UoF (figure 2 of 2)

Annex H
(informative)

AIM EXPRESS-G

This annex will be developed for the CD version of this document.

Annex J
(informative)

Computer interpretable listing

It also provides a listing of each EXPRESS schema specified in this part of ISO 10303 without comments or other explanatory text. These listings are available in computer-interpretable form and can be found at the following URLs:

Short names: http://www.mel.nist.gov/div826/subject/apde/snr/
EXPRESS: http://www.mel.nist.gov/step/parts/partnnn/is/

If there is difficulty accessing these sites contact ISO Central Secretariat or contact the ISO TC 184/SC4 Secretariat directly at: sc4sec@cme.nist.gov.

NOTE - The information provided in computer-interpretable form at the above URLs is informative. The information that is contained in the body of this part of ISO 10303 is normative.

Annex K
(informative)

Technical Discussion

K.1 Arrangement (Internal Subdivision)

The hull form of a ship is internally subdivided early in the design lifecycle by the introduction of many additional surfaces. These surfaces are associated with the molded hullform elements such as bulkheads and decks. Structural entities such as plate parts and stiffeners will be defined on these surfaces as the design progresses. A region of the ship --whether it be interior to the hull such as a tank or enclosing one if its exposed decks such as a helicopter landing platform-- is designated a space. Two types of spaces are addressed by this AP --compartments and zones. Compartments which represent physical, bounded spaces and zones, which represent regions surrounded by some abstract boundary.

The most common type of spatial partioning is the sudivision of a ship into compartments. A compartment is very similar to the idea of a room in a building. The compartment is bounded by the surfaces representing structural decks and bulkheads and also by non-structural (or non load bearing) surfaces that form "joiner bulkheads". Compartments may be classified according to the function they perform with regard to the operation of the ship. The types of spaces supported by this AP are cargo/stowage (both liquid and dry cargo), void, habitable, and machinery/equipment. Collections of attributes have been defined for the various compartments depending on its designated use. Compartments serve a vital function in configuration managing engineering part occurrences throughout the lifecycle of the ship.

In some cases, the same surfaces that subdivide a ship into compartments may also be used to subdivide the ship into zones. In other cases, additional hullform geometry elements and/or geometric surfaces may be required to define zone boundaries. On naval ships, multiple zone subdivisions --such as, pressure (Collective Protection System), subsafe, damage control, and arrangement zones-- will be defined and each subdivides the hull into an independent set of spaces. Sometimes, two zones may have the same boundary, however, each zone is still independently represented.

In addition to identifying the various spaces on the ship, it is important to represent the connectivity between these spaces. This model supports several types of relationships between spaces, specifically adjacency, functional, positional, and enclosing. Adjacency relationships are established via a connectivity network based on the connection/joint model presented earlier in this document. Characteristics such as accessibility, access time, and common surface area between adjacent spaces are provided such that analyses to determine transit times between areas of the ship and HVAC load calculations can be supported. Functional relationships can be used to record the fact that one space's design parameters are dependent on some functional characteristic of another spaces --such as a pair of port and starboard ballast tanks used for anti-roll stabilization. Positional relationships capture design intent expressing the fact that certain spaces must maintain geometric characteristics similar to another spaces' --such as two spaces that should maintain the same transverse width dimension. Finally, enclosing relationships allow the product model to record the

fact that one space may be completely surrounded by another space --such as a free-standing Lube Oil Settling Tank in the Machinery Space.

From a functional standpoint, the model has been developed to associate properties with the various compartments appropriate to their function. These properties include volumetric capacities, length measures, and cross-sectional areas. The ability to specify constraints on these properties is provided for where appropriate so as to assist engineers in the early stages of design. For example, it is possible to specify a minimum length for a compartment, as well as a maximum length for the compartment. Likewise, it is possible to record an estimated compartment volume, as well as a calculated and a measured. Longitudinal and transverse grids can be defined for an arrangement zone that can be used to restrict the free placement of bulkheads such that they align with the grid points.

K.1.1 Compartments

A ship is divided horizontally by decks, platforms, flats, levels, and the bottom shell. These divisions apply to the entire ship, both in the main hull and in the superstructure (or deckhouse). Deck gratings, false decks, or similar flats are not considered as division boundaries. Between horizontal division boundaries, the ship is divided vertically by tight or nontight bulkheads. Except for spaces designated as voids, cofferdams, or tanks, only tight boundaries are considered.

Every volume enclosed by horizontal and vertical boundaries (except for minor utility areas such as peacoat lockers, linen lockers, cleaning gear lockers, and other similar areas) is considered a compartment. Some compartments, by this definition, may or may not have access closures. Compartments are assigned a compartment name and a compartment number. Compartments that extend vertically through more than one horizontal division boundary, such as machinery spaces and deep tanks, are considered to be located on the lowest horizontal boundary.

Figure F-140 illustrates the subdivision of one deck of a typical Naval vessel. The following table presents a listing of common compartment attributes --such as compartment name, compartment number, and applicable design zone-- for a similar vessel

COMPARTMENT NUMBER	COMPARTMENT	DESIGN ZONE
1 - 46-0 -M	5"/54 CALIBER LOADER DRUM & FAN ROOM	1350
3 - 52-1 -M	5"/54 CALIBER POWDER MAGAZINE NO.1	1330
3 - 42-01-M	5"/54 CALIBER POWDER PROJECTILE MAGAZINE	1330
1 -364-1 -T	ACCESS TRUNK	2450
1 -140-2 -Q	ADMINISTRATION OFFICE	4210
1 -196-1 -T	ACCESS TRUNK	2450
2 -310-1 -L	AFT BATTLE DRESSING STATION	3440

K.1.2 Design Zones

One common type of internal subdivision is the "design" zone. Whereas a compartment is a subdivision involving the functional aspects of a completed, or in-service, ship, a design zone is associated with the manufacturing of a ship by the design agent and/or shipbuilder. Design zones are used to break up the ship into blocks for facilitating design and construction.

Design zones, like compartments, are bounded by surfaces representing decks, bulkheads, the hull, and so on. They may also be bounded by other surfaces. A common use of the design zone is to configuration manage aspects of the ship design process within its bounds. For this reason, the subdivision model model has been developed to allow product structuring by zone. Structural parts, structural assemblies, and engineering parts can all be associated with a particular zone of the ship. Figure F-141 illustrates the design zones of the DDG-51, the lead ship of the Arleigh Burke class destroyer.

K.1.3 Fire Zones

The design of a naval ship is likely to provide fire containment capablities. A Damage Control Console provides remote control fire containment at a central site. The ship design process entails subdividing the vessel into a number of fire zones. A fire zone boundary is a physical boundary designed to retard the passage of flame and smoke from one area of the ship to the next. All fire

zone boundaries are watertight or fumetight bulkheads. Fire zone boundaries in the hull are constructed of steel. Bulkheads in the superstructure, if aluminum, are covered with non-combustible thermal insulation. Each fire zone boundary on the Damage Control Deck is provided with spring loaded, joiner type, fire doors, each held open by an electromagnetic catch. An adjacent quick acting watertight door is also provided. Each fire zone has fire, smoke, and heat sensors which activate a central display on the hazard detection panel of the Damage Control Console and enable the ship's crew to safely and effectively monitor and control onboard fires.

K.1.4 Collective Protection System (CPS) Zones

Another type of zone common on Naval ships is a pressure zone. These pressure zones are used to define regions of the ship that have been designed to maintain a pressure slightly higher than that of the outside atmosphere. These zones, commonly referred to as collective protection system (CPS) zones, are necessary to combat biological and nuclear warfare. The air pumped into these zones is specially filtered to remove harmful contaminants. As with fire zones discussed above, the boundaries of these zones are fitted with special types of automatic closures to secure the zones in an emergency.

K.1.5 Arrangement Zones

The last type of zone to be discussed here is the arrangement zone. This zone is used early in the design to control and manage the arrangement of compartments on the ship. An individual or workgroup may be assigned a collection of compartments that are to be arranged within a given domain (i.e. the arrangement zone). Working within the bounds of this zone, the designers can define the compartment boundaries according to the requirements for the spaces --such as number of crew, amount of cargo, etc. To facilitate standardization, longitudinal and transverse grids may be established that constrain the placement of bulkheads.

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